NOTICE

All drawings located at the end of the document.

000006573

DELIVERABLE (COMBINED 235A, 236A, AND 235E, 236E)

ATTACHMENTS

TO

TREATABILITY STUDY REPORT

AND PROCESS FORMULATION REPORT

FOR

POND 207C AND CLARIFIER

REVISION 0

HALLIBURTON NUS ENVIRONMENTAL CORPORATION
PITTSBURGH, PENNSYLVANIA 15220

JULY 1992

JUL 1992
RECEIVED
Pondcrete
Project

u/nu

"REVIEWED FOR CLASSIFICATION
By
Date 7-13-92"

HALLIBURTON NUS
Environmental Corporation

NOTICE:

INCOMPLETE DOCUMENT

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The Adminstrative Record Staff

APPENDIX A

JANUARY 8, 1992 MEMORANDUM SUMMARIZING PRELIMINARY 207C TREATABILITY STUDY RESULTS

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-01-92-57

DATE: JANUARY 8, 1991

TO: TED BITTNER

FROM: TOM SNARE TLS.

COPY: RICH NINESTEEL
DONALD BRENNEMAN
SHAJ MATHEW
JOHN ZAK
JERRY CHILDS
FILE 2K68

SUBJECT: OBSERVATIONS FROM PRELIMINARY 207C TREATABILITY STUDY - EG&G ROCKY FLATS STABILIZATION PROJECT REVISION NO. 1

1.0 Purpose

The goal of this testing was to initiate an early study for the solidification of the 207C pond sludge, crystals and water (i.e., slurry). This slurry was solidified using lime, cement and flyash, with the second mix adding HALLIBURTON Services Latex 2000 System. The intent is to observe mixing characteristics, establish long term disability of the mixes, and analyze for TCLP constituents for an initial starting point for subsequent testing.

2.0 Procedure

The slurry of 207C pond sludge, crystals and water was solidified using two different mixtures. The first mixture consisted of slurry, lime (to pH 11), Type C flyash and portland type I-II cement. The second mixture was essentially the same except for the addition of the LATEX 2000 System. The LATEX 2000 system included D-AIR 3, stabilizer 434C and LATEX 2000. Solidification mixture ratios are described in Table 2-1. Nine cylinders were filled for both mixtures. The mixing was completed on November 25, 1991.

3.0 Results

BATCH #1 - The crystal part of the sludge was ground to a -10 mesh size. The crystals were then combined with the water and sludge to form the slurry. While in this slurry, the crystals visually reformed to a size of +10 mesh. Upon the addition of cement and flyash the crystals dissipated based on the feel of the mix during hand mixing.

After the blending with the HOBART mixer the consistency of the mixture was described as "very runny, but started to set up by the time the last cylinder was poured."

BATCH #2 - After the blending with the HOBART mixer, the consistency of the mixture was described as "thicker than Batch #1 and started to set up during molding." The mixture had to be spooned into the molds.

A visual observation was performed after 5 days of NORMAL curing; both batches were described as being hard. After 24 days of curing, samples from both batches were submitted for UCS, TCLP (metals) and durability tests. The following results were reported:

UCS	Result
Batch #1	>600 psi
Batch #2	>600 psi

TCLP Preliminary Data

As shown in Table 3-1.

Durability Tests

1. Freeze/Thaw

   The samples submitted from Batch #1 continue to be cycled with small hair-line cracks appearing. Samples submitted from Batch #2 developed cracks and crumbled, and were deemed a failure after 3 cycles on December 31, 1991.

2. Wet/Dry

   The samples submitted from Batch #1 cracked and crumbled thus failing on January 6, 1992 after 8 cycles. Samples from Batch #2 continue to be cycled.

4.0 Conclusions

1. Both batches were within regulatory standards (toxicity characteristic and LDR standards) based on the TCLP results.

2. The addition of the Latex 2000 System enhanced resistance to wet/dry cycling but decreased resistance to freeze/thaw cycling.

3. No efflorescence has been observed to date.

TLS/pam

TABLE 2-1

SOLIDIFICATION MIXTURE RATIOS

	Batch #1		Batch #2	
	Grams Added	% (by wt.)	Grams Added	% (by wt.)
Pond Water	1430g	35.7	1430g	33.7
Pond Sludge	286g	7.1	286g	6.7
Pond Crystals	286g	7.1	286g	6.7
Lime	to pH 11	---	to pH 12	---
Cement Type I-II	667g	16.7	667g	15.7
Flyash Type C	1334g	33.3	1334g	31.4
Latex 2000	NA	---	200g	4.7
Stabilizer 43B	NA	---	32g	0.75
D-Air-3	NA	---	9g	0.21

NA: Not Added

TABLE 3-1

TCLP PRELIMINARY DATA (mg/L)

Analyte	Batch #1	Batch #2	Toxicity Characteristic Standard	Nonwastewater LDR Standard
TCLP Leaching Procedure	DONE	DONE	5.0	---
Arsenic, Leachable (As)	0.42	0.46	100.0	---
Barium, Leachable (Ba)	0.50	0.51	1.0	0.066
Cadmium, Leachable (Cd)	<0.005	<0.005	5.0	5.2
Chromium, Leachable (Cr)	0.22	0.20E	5.0	0.51
Lead, Leachable (Pb)	<0.02	<0.02	0.2	---
Mercury, Leachable (Hg)	<0.00008	<0.00008	1.0	---
Selenium, Leachable (Se)	<0.08	<0.08	5.0	0.072
Silver, Leachable (Ag)	<0.003	<0.003	---	0.32
Nickel, Leachable (Ni)	<0.03	0.03	---	---
Iron, Leachable (Fe)	0.014	0.022	---	---
Aluminum, Leachable (Al)	3.6	4.0	---	---
Calcium, Leachable (Ca)	640	590E	---	---
Magnesium, Leachable (Mg)	0.07	0.07	---	---

NOTE: Batch #1 - Final pH of TCLP is 11.7.
Batch #2 - Final pH of TCLP is 11.7. E-Serial dilution result did not agree with the original results within 10%. Matrix interference should be suspected.

APPENDIX B

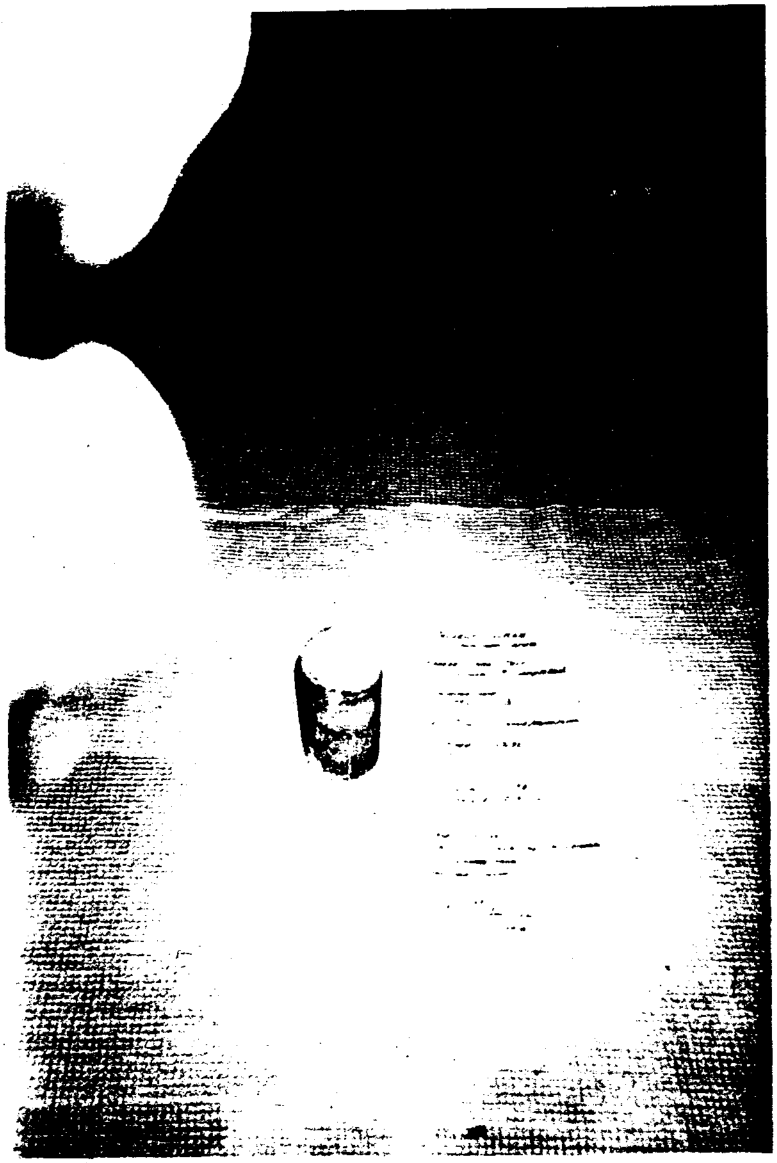
PHOTOGRAPHS OF CYLINDERS AFTER DURABILITY TESTING

THE ORIGINALS OF THESE PHOTOS WERE DISTRIBUTED TO D. BRENNEMAN, J. CHILDS, AND THE PITTSBURGH HALLIBURTON NUS FILE (2K68).

LIME/CEMENT/FLYASH

FREEZE/THAW

5 CYLINDERS



ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

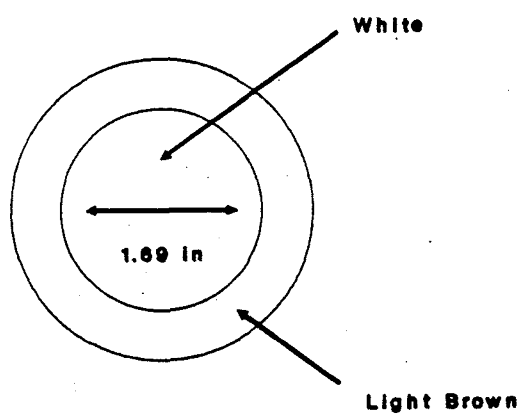
FREEZE/THAW TEST (Accelerated)
~~In cycle.~~ ~~#Completed~~ 5 cycles completed

CYLINDER NAME:
M1 1.3

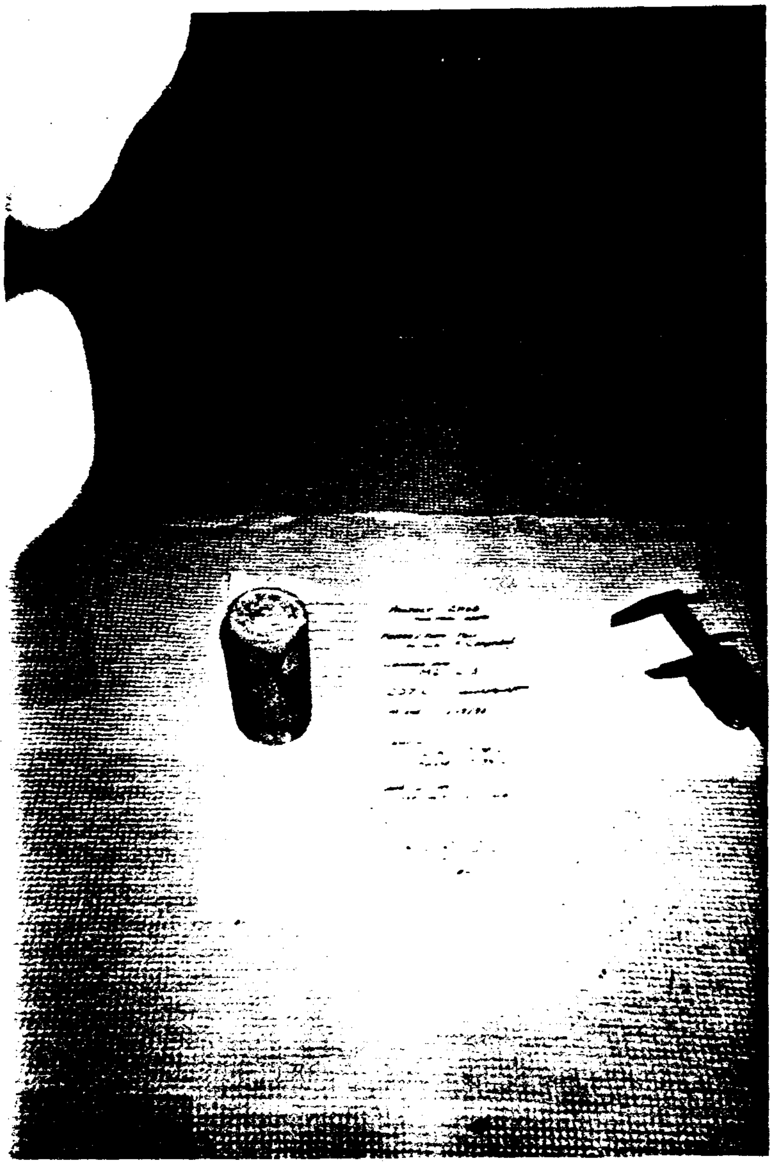
207C CEMENT/FLYASH/LIME
Mix 1
Mixed 1/17/92

OBSERVATIONS:
Dia: 1.98 in.
Height: 3.91 in.

Deep scratches
Hairline crack with a ~~complete~~ complex
longitudinal face



M1 1.3



ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

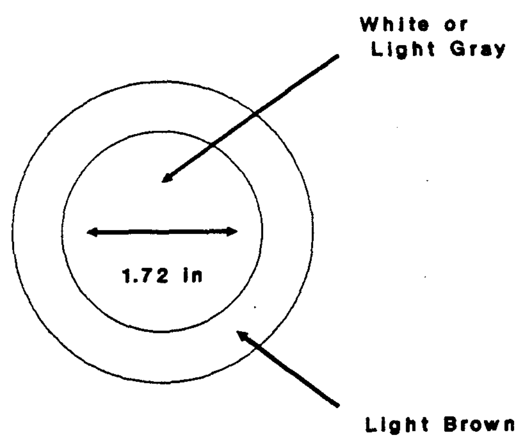
FREEZE/THAW TEST (Accelerated)
~~In cycle. #Completed~~ 5 cycles completed

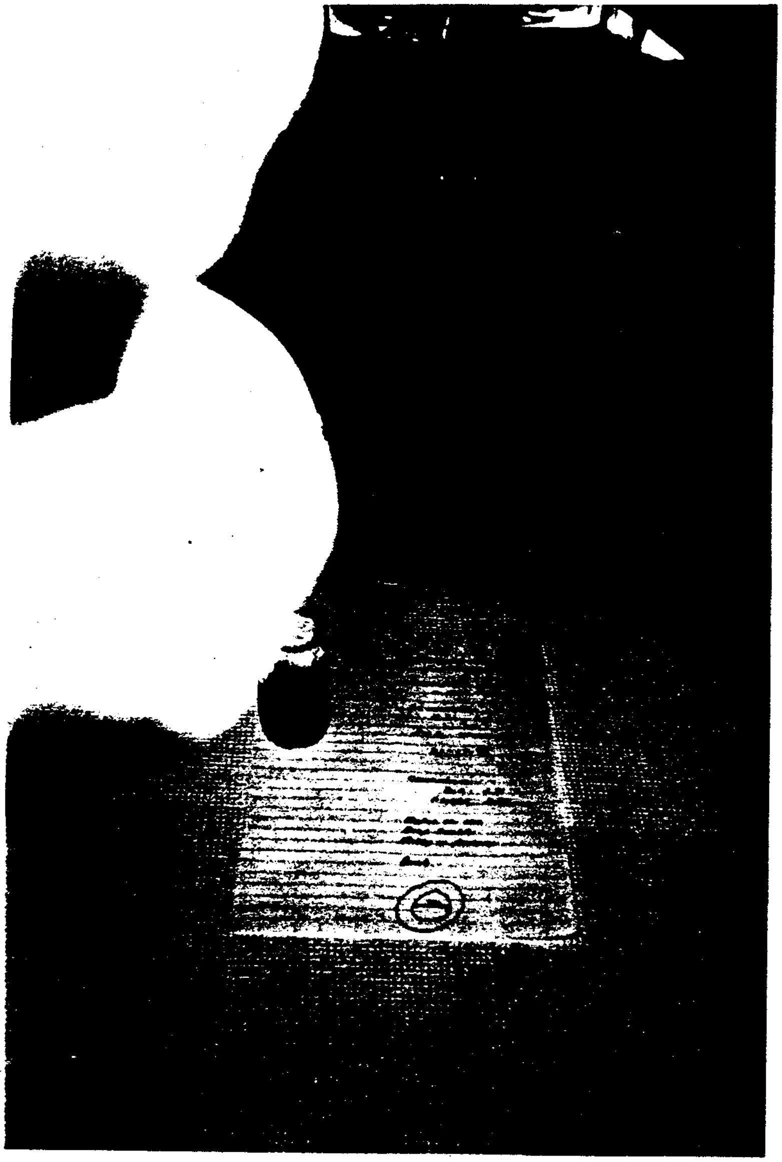
CYLINDER NAME:
M2 2.3

207C CEMENT/FLYASH/LIME
Mix 2
Mixed 1/17/92

OBSERVATIONS:
Dia: 2.00 in.
Height: 3.94 in.

Good cylinder
Slight hairline cracks





ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

FREEZE/THAW TEST (Accelerated)
~~In-cycle: #Completed~~ 5 cycles completed

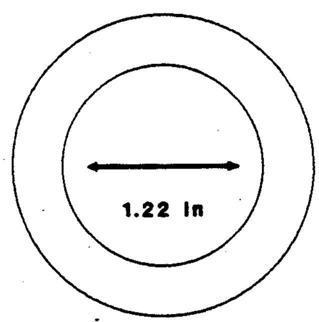
CYLINDER NAME:
M3 3.3

207C CEMENT-FLYASH-Lime

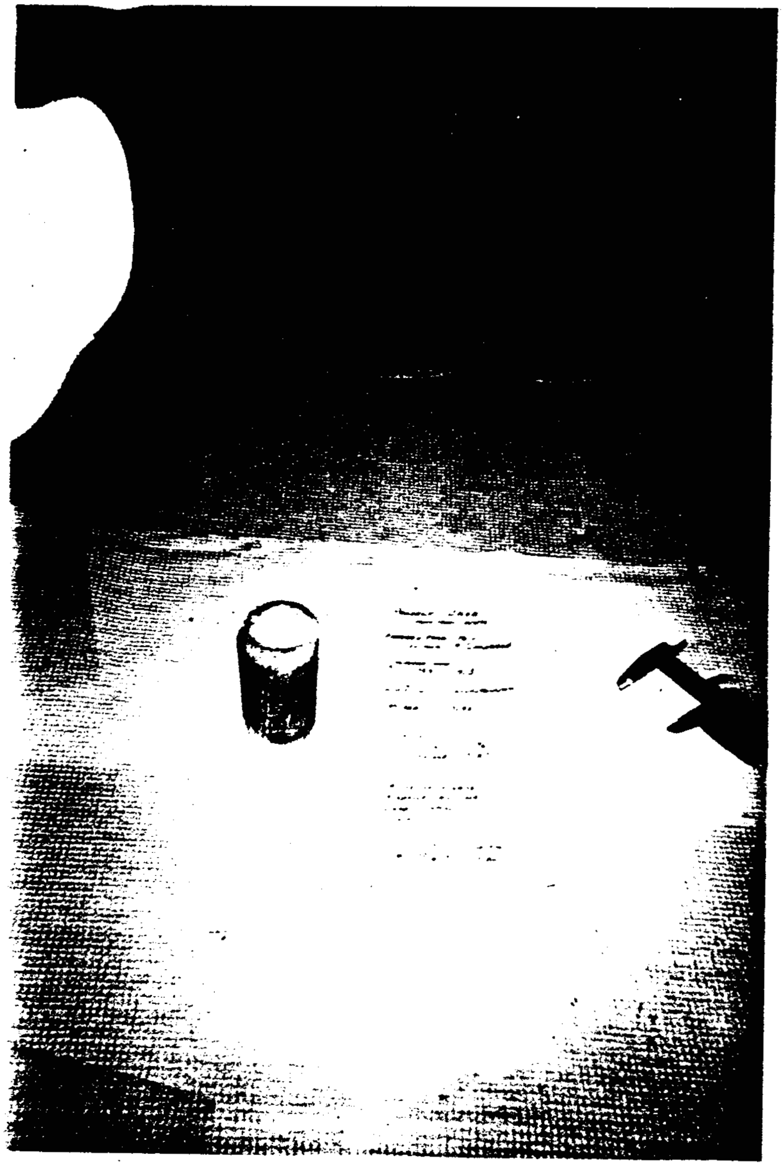
Mixed 1/17/92

OBSERVATIONS:
Dia: 1.91 in.
Height: 3.70 in.

Elephant like skin
Deep scratches
Flaking or powdering
Donut



M3 3.3



ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

FREEZE/THAW TEST (Accelerated)
~~In cycle: #Completed~~ 5 cycles completed

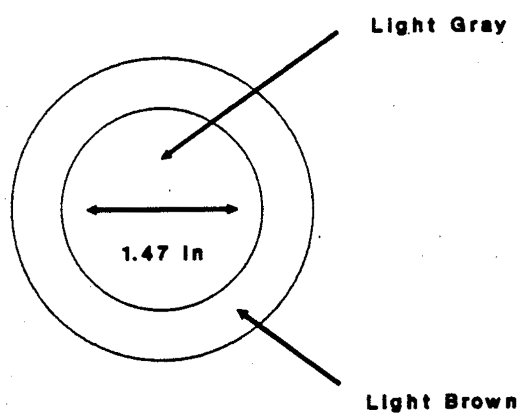
CYLINDER NAME:
M4 4.3

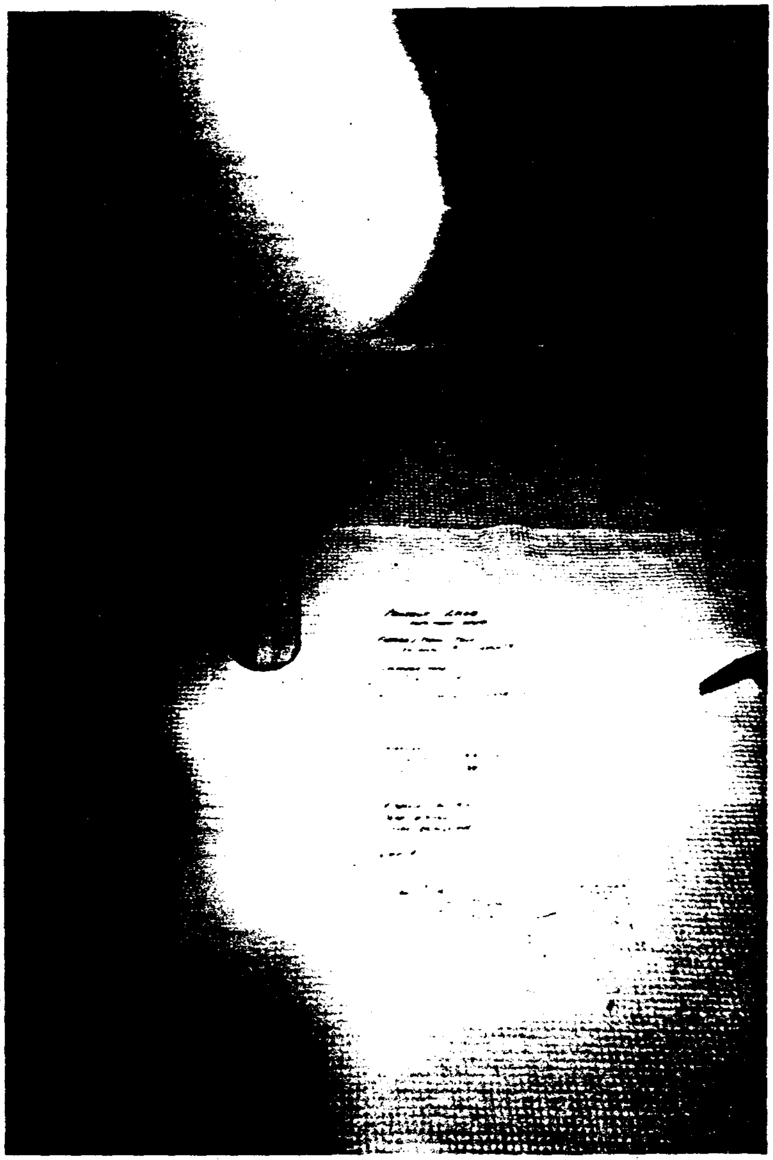
207C CEMENT/FLYASH/LIME

Mixed 1/17/92

OBSERVATIONS:
Dia: 1.96 in.
Height: 3.87 in.

A lot of flaking
Elephant skin look
Deep scratches
Donut





ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

FREEZE/THAW TEST (Accelerated)
~~In cycle. #Completed~~ 5 cycles completed

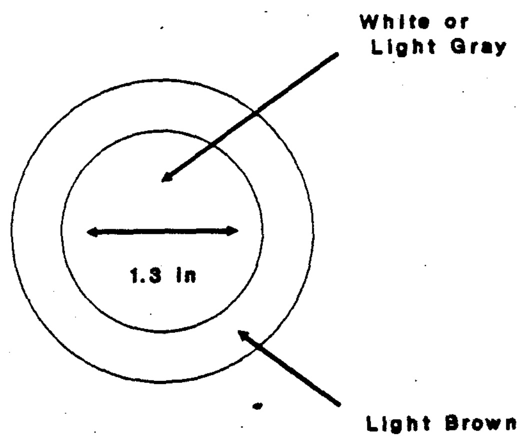
CYLINDER NAME:
M5 5.3

207C CEMENT-FLYASH-Lime

Mixed 1/17/92

OBSERVATIONS:
Dia: 1.99 in.
Height: 3.88 in.

Elephant like skin
Deep grooves
Cracks throughout
Donut



M5 5.3

LIME/CEMENT/FLYASH

WET/DRY

5 CYLINDERS

ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

WET/DRY TEST
~~In cycle: #Completed~~ 5 cycles completed

CYLINDER NAME:
M1 1.2

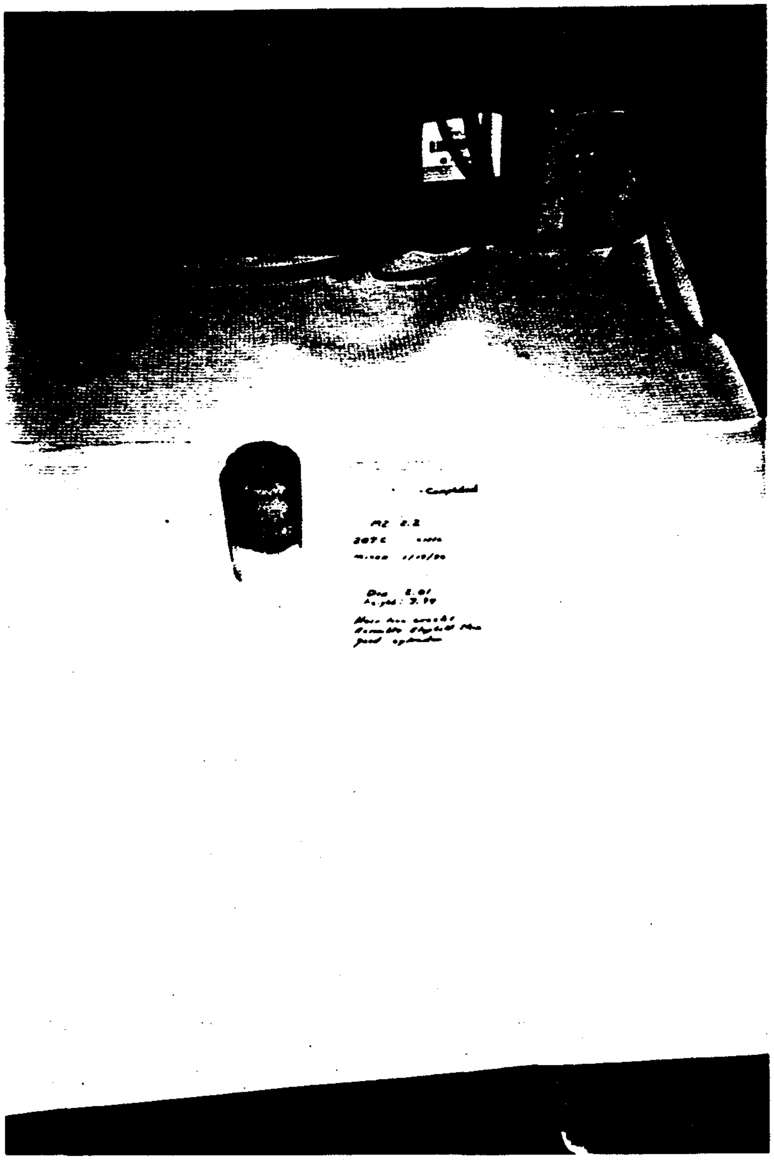
207C CEMENT/FLYASH/LIME

Mixed 1/17/92

OBSERVATIONS:
Dia: 1.99 in.
Height: 3.93 in.

Hairline cracks
Resembles elephant skin
Cylinder looked good

M1 1.2



ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

WET/DRY TEST
~~In cycle: #Completed~~ 5 cycles completed

CYLINDER NAME:
M2 2.2

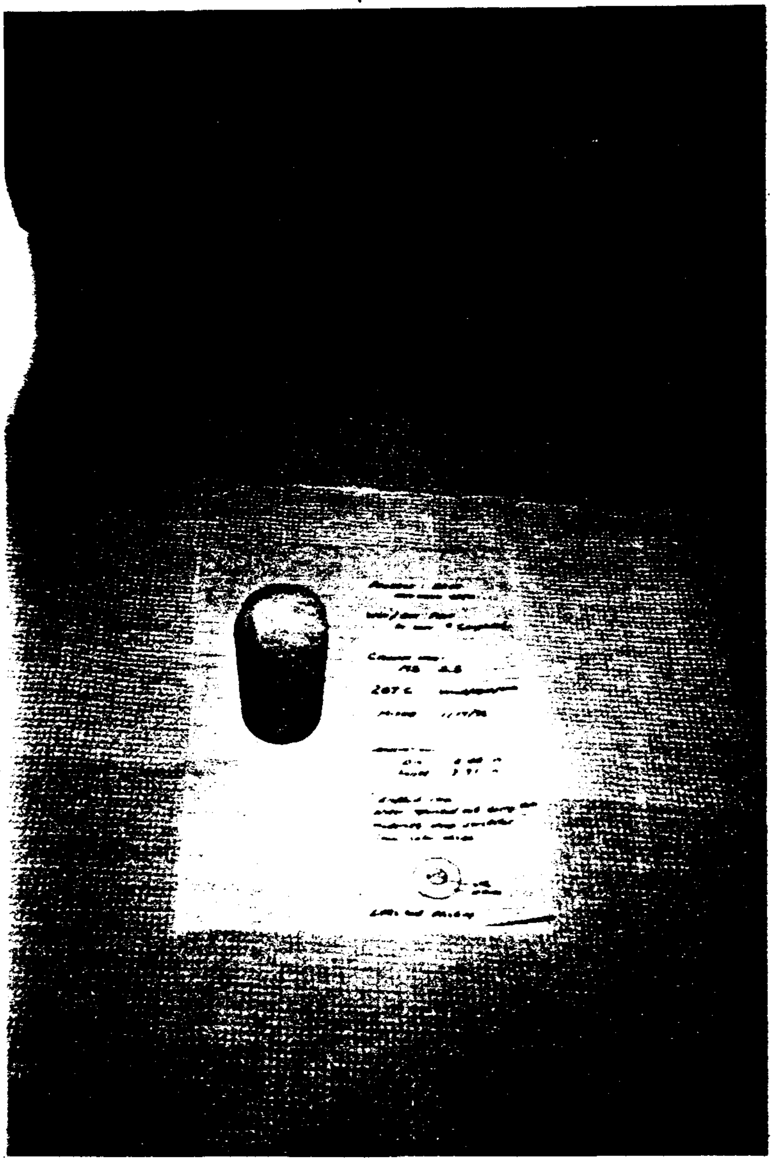
207C CEMENT/FLYASH/LIME

Mixed 1/17/92

OBSERVATIONS:
Dia: 2.01 in.
Height: 3.94 in.

Hairline cracks
Resembles elephant skin
Good cyliner

M2 2.2



ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

WET/DRY TEST
~~In cycle: #Completed~~ 5 cycles Completed

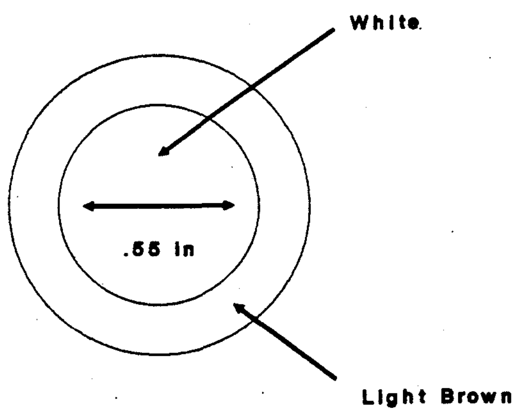
CYLINDER NAME:
M5 5.5

207C CEMENT/FLYASH/LIME

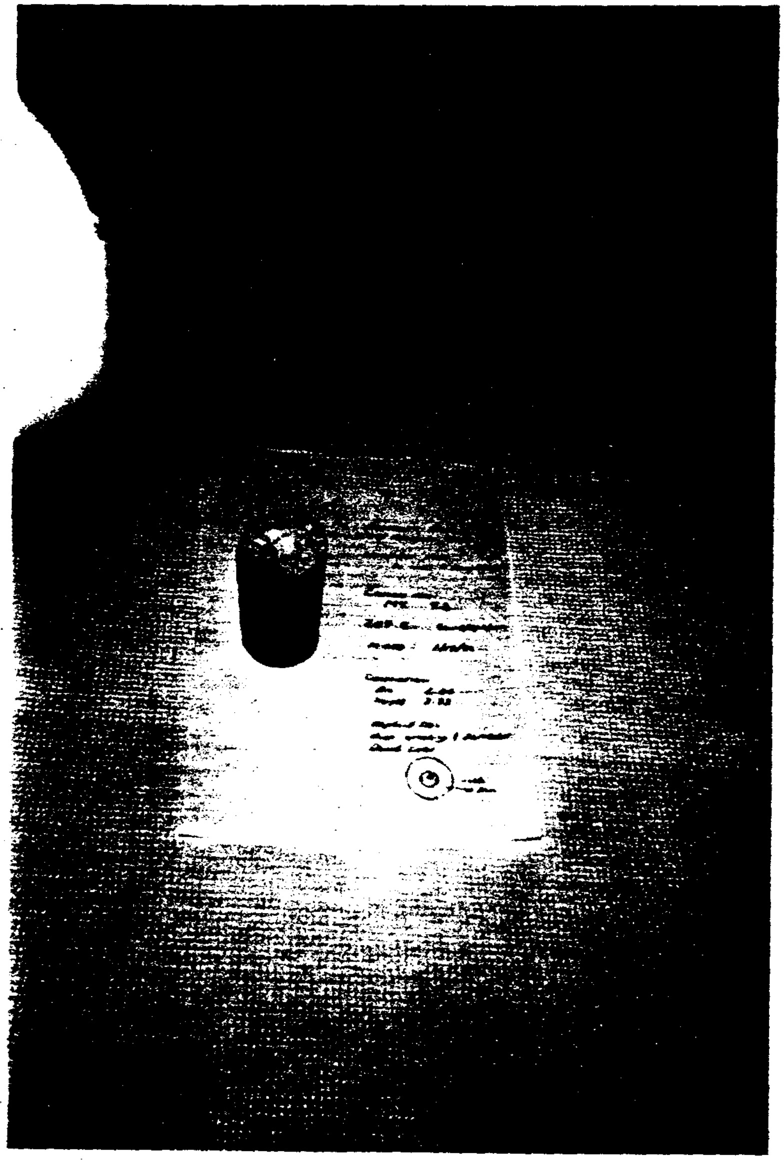
Mixed 1/17/92

OBSERVATIONS:
Dia: 2.00 in.
Height: 3.91 in.

Elephant skin
Water separated out during cure
Moderately deep scratches
Some color change
Little end flaking



M5 5.5



ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

WET/DRY TEST
~~In cycle: #Completed~~ 5 cycles completed

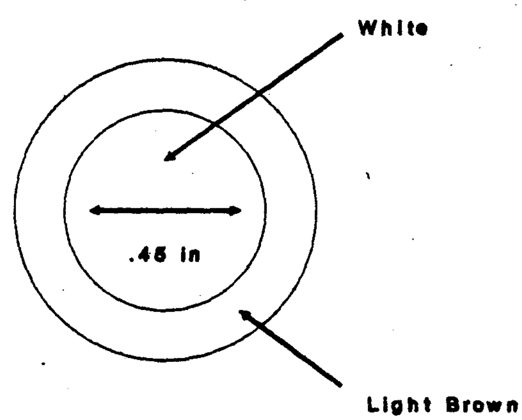
CYLINDER NAME:
M4 4.2

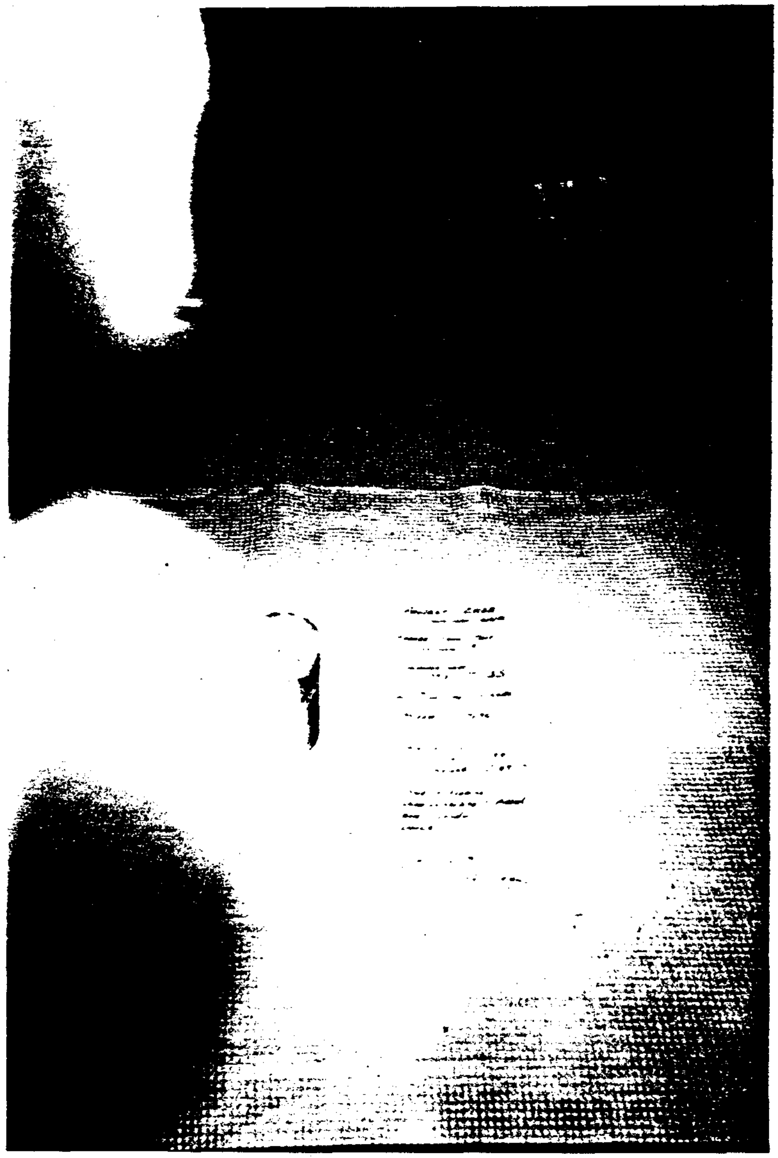
207C CEMENT/FLYASH/LIME

Mixed 1/17/92

OBSERVATIONS:
Dia: 2.00 in.
Height: 3.93 in.

Elephant skin
Deep cracking and scratches
Donut color





ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

FREEZE/THAW TEST
~~In cycle: #Completed~~ 5 cycles completed

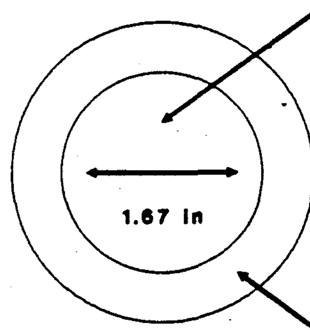
CYLINDER NAME:
M1 M1.3S

207C w/ SILICATE

Mixed 1/17/92

OBSERVATIONS:
Dia: 1.99 in.
Height: 3.84 in.

A lot of flaking
Deep scratching and pitted
Bad cylinder
Donut

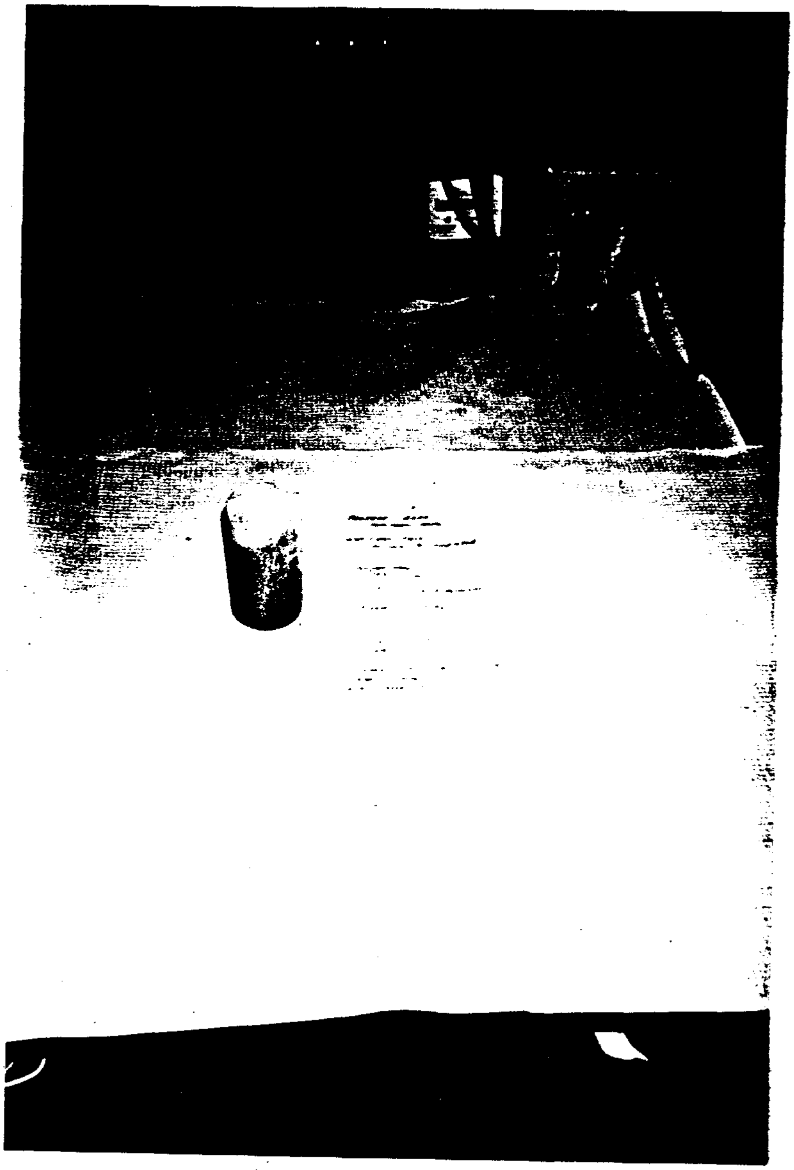


M1 M1.3S

LIME/CEMENT/FLYASH AND SODIUM SILICATE

FREEZE/THAW

9 CYLINDERS



ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

WET/DRY TEST
~~In cycle: #Completed~~ 5 cycles completed

CYLINDER NAME:
M3 3.2

207C CEMENT/FLYASH/LIME

Mixed 1/17/92

OBSERVATIONS:
Dia: 1.99 in.
Height: 3.71 in.

Elephant skin/hairline cracks
Deep scratches
Ends flaked off

M3 3.2

TABLE 3-1

BATCHES FOR 207C STABILIZATION
LIME/CEMENT/FLYASH + PLASTIC FIBERS

	Sludge Mixture	Cement	Flyash	Plastic Fibers
Batch 1	2000g	625g	2084g	0.75g
Batch 2	2000g	1041g	2084g	0.87g
Batch 3	2000g	625g	1250g	0.52g
Batch 4	2000g	1041g	1250g	0.64g
Batch 5	2000g	833g	1667g	0.69g

TABLE 3-2

SUMMARY OF TESTING SCHEDULES
207C - LIME/CEMENT/FLYASH + PLASTIC FIBERS

Curing Time	UCS	TCLP (Metals)	Freeze/Thaw + UCS	Wet/Dry + UCS
48 hrs*	1	1	1	1
7-day	2	NA	NA	NA
14-day	1	NA	NA	NA
28-day	1	NA	NA	NA

* Accelerated Cure
NA - Not Analyzed

3.3 RESULTS

Table 3-3 summarizes the TCLP metals data for the 48-hour accelerated cure samples. All samples easily passed TCLP requirements for the LDRs and the characteristic of toxicity. It is noted that the pH of the TCLP extract was consistently greater than 10.

Table 3-4 summarizes all available UCS data (28-day regular cure data are not yet available). All cylinders achieved >600 psi with the exception of Batch 3, 7-day duplicate, and Batch 5, 14-day. Both of these results appear to be anomalous readings based on the other available data.

TABLE 3-4

UCS RESULTS (psi)
207C - LIME/CEMENT/FLYASH + PLASTIC FIBERS

Mix	48 Hr.*	7-Day	7-Day (Dup.)	14-Day	28-Day
Batch 1	>631	>637	>637	>637	>637
Batch 2	>631	>637	>637	>637	>637
Batch 3	>631	>637	325	>637	267
Batch 4	>631	>637	>637	>637	>637
Batch 5	>631	>637	>637	392	>637

* Accelerated Cure
  Dup. - Duplicate

Table 3-5 summarizes durability data from the freeze/thaw and wet/dry tests performed on the accelerated cure cylinders. As with the straight lime/cement/flyash mixes, Batch 2 (highest cement and flyash concentratons) produced the best results. The results shown in Table 3-5 roughly parallel those in Table 2-5, which indicates no benefit for durability from the addition of plastic fibers.

TABLE 3-5

207C SLURRY WITH LIME/CEMENT/FLYASH/PLASTIC FIBERS DURABILITY TEST RESULTS

	UCS Before Durability Testing (psi)	FREEZE/THAW		WET/DRY	
		% Wt. Loss	UCS After Durability Test (psi)	% Wt. Loss	UCS After Durability Test (psi)
Batch 1	>631	26	>637	25	>637
Batch 2	>631	20	>637	16	>637
Batch 3	>631	34	379	30	142
Batch 4	>631	27	220	23	565
Batch 5	>631	25	337	20	>637

NOTE: All cylinders passed the required 12 cycles for the durability test unless otherwise noted.

All testing was performed on 48-hour accelerated cure samples.

% weight loss is approximated and is a combination of any moisture loss plus mass lost as a result of the brushing after each cycle.

4.0 STABILIZATION OF POND 207C LIME/CEMENT/FLYASH + SODIUM SILICATE

4.1 PURPOSE

The purpose of this series of tests is to analyze the effect of adding sodium silicate to the previously established mixtures of lime/cement/flyash utilizing factorial experimentation (3x2). This experiment is conceptually illustrated in Figure 4-1.

4.2 PROCEDURE

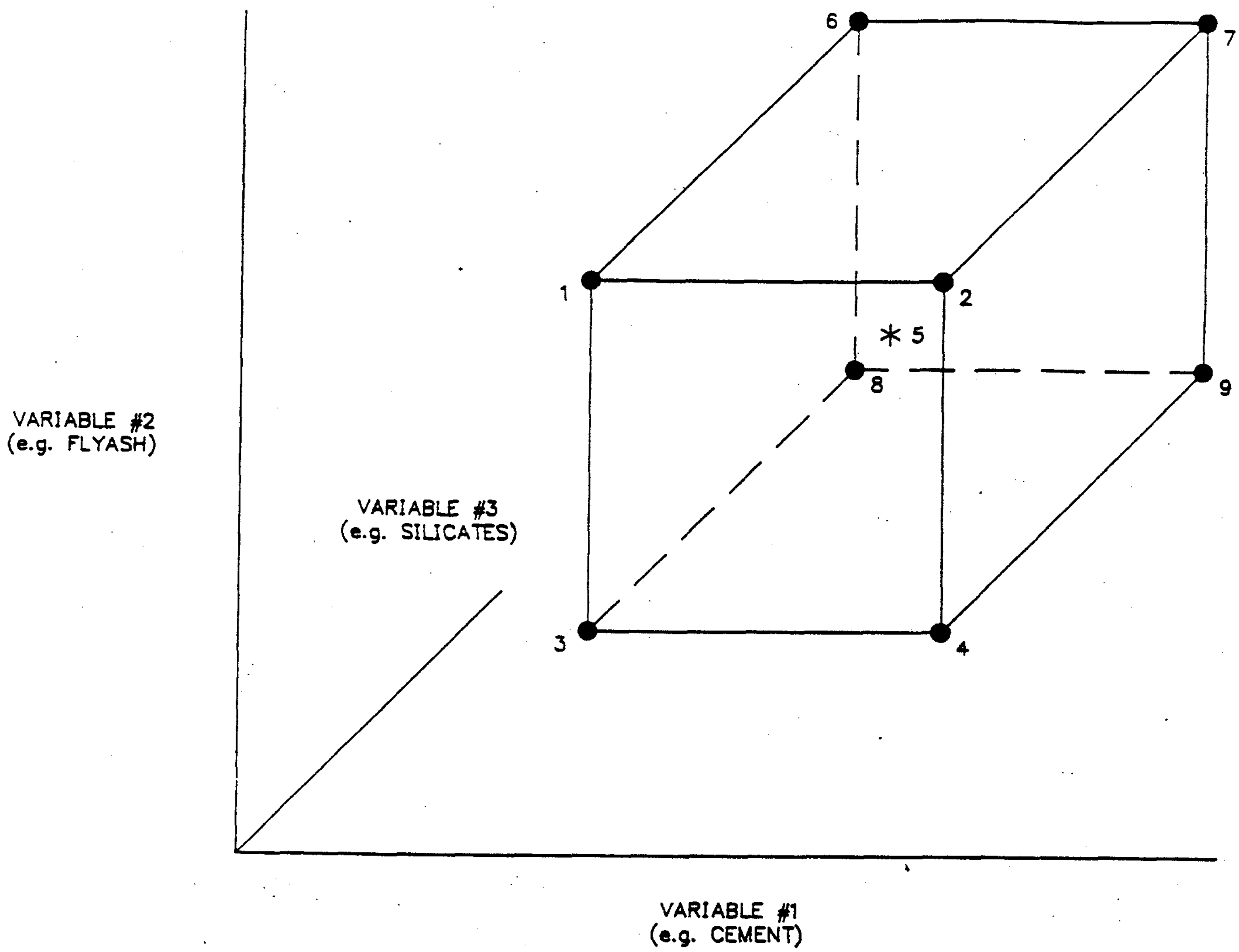
Initially a sludge mixture was made using 5 parts pond water, 1 part crystal, and 1 part underlying sludge (by volume). This ratio of the "sludge mixture" was held constant for all 9 batches. The batches that were mixed are defined in Table 4-1 with Batch #5 being the previously defined center point.

Hydrated lime was used to achieve a pH of 11.5 to 12 in the sludge mixture. Following the pH adjustment, Type V cement, Type C "pawnee" flyash, and sodium silicate were added. The mixture was wet mixed for 5 min.

The mixtures incorporated sodium silicate at 5% to 15% of the total weight of the pozzolanic material in the mixture.

Eight cylinders were made for each batch. After curing, cylinders were tested for UCS using ASTM Method C39-86. TCLP extraction and metals analysis were also conducted. The freeze/thaw and wet/dry durability test procedures were modified to enable the testing to be completed prior to the start of the final phase. The control cylinder (i.e., volume and moisture loss specimen) was omitted, thus only one cylinder was submitted for each test. The dimension measurements and the weighing of the cylinders was done as specified in the methods. The freeze/thaw procedure was accelerated by reducing the time of freezing from 24 hours/cycle to 12 hours/cycle. The wet/dry procedure was accelerated by decreasing the drying period from 42 hours to 19 hours and the time of submergence from 5 hours to 4 hours. Table 4-2 defines curing times and the cylinders required for each test.

FIGURE 4-1



LEGEND

* CENTER POINT CONCENTRATION

● CONCENTRATIONS ± %
AROUND CENTER POINT

TABLE 4-1

BATCHES FOR 207C STABILICATION
LIME/CEMENT/FLYASH + SODIUM SILICATE

	Sludge Mixture	Cement	Flyash	Sodium Silicate
Batch 1	2000g	625g	2084g	31.25g
Batch 2	2000g	1041g	2084g	52.05g
Batch 3	2000g	625g	1250g	31.25g
Batch 4	2000g	1041g	1250g	52.05g
Batch 5	2000g	833g	1667g	83.3g
Batch 6	2000g	625g	2084g	93.75g
Batch 7	2000g	1041g	2084g	156.15g
Batch 8	2000g	625g	1250g	93.75g
Batch 9	2000g	1041g	1250g	156.15g

TABLE 4-2

SUMMARY OF TESTING SCHEDULE 207C
LIME/CEMENT/FLYASH + SODIUM SILICATE

Curing Time	UCS	TCLP (Metals)	Freeze/Thaw + UCS	Wet/Dry + UCS
48 hrs*	1	1	1	1
7-day	2	NA	NA	NA
14-day	1	NA	NA	NA
28-day	1	NA	NA	NA

* Accelerated Cure
NA - Not Analyzed

4.3 RESULTS

Table 4-3 presents the TCLP data for the accelerated cure samples using lime/cement/flyash with sodium silicate. All batches passed both LDR standards and toxicity characteristic standards. The data show sensitivity to the pH of the TCLP extract, where the extract concentrations of certain metals (cadmium, nickel) approach their respective LDR standards when the pH drops below 8-9.

Table 4-4 summarizes available UCS data (28-day regular cure data are not available). The data clearly show a pattern of UCS strength directly related to the total amount of pozzolan added (Batches 2,7 > 1,6 >5 > 4,9 > 3,8). When batches of equal pozzolan addition are compared (for instance Batches 2 and 7), with the only variable being the amount of sodium silicate added, the results appear to be comparable. Therefore, the concentration of sodium silicate (5% to 15% of cement by weight) appears to have little effect on the UCS results. When these results are compared to those for straight lime/cement/flyash (see Tables 2-2 and 2-4), no advantage is shown by the addition of silicates at all concentrations, and some disadvantage is noticed on some of the accelerated cures.

Table 4-5 summarizes the durability test data. Only Batches 2 and 7, with the highest cement and flyash concentrations, passed both tests while maintaining their UCS. Comparison of the data on Table 4-5 seems to show a decrease in final UCS at the 15% silicate concentrations vs. the 5% concentrations. Comparison of data in Table 4-5 to data in Table 2-5 (straight lime/cement/flyash) clearly shows that the addition of silicates at all concentrations tested reduces the strength at the end of durability testing, as measured by UCS.

TABLE 4-3

48 hr ACCELERATED CURE TCLP RESULTS (mg/L)
207C - LIME/CEMENT/FLYASH + SODIUM SILICATE

ANALYTE	BATCH #1	BATCH #2	BATCH #3	BATCH #4	BATCH #5	BATCH #6	BATCH #7	BATCH #8	BATCH #9	TOXICITY CHARACTER -ISTIC STANDARD	NONWASTE-WATER LDR STANDARD
Arsenic, Leachable (As)	0.285	0.141	0.150	0.179	0.249	0.160	0.163	0.186	0.155	5.0	---
Barium, Leachable (Ba)	0.381	0.610	0.722	0.524	0.437	0.648	0.695	0.799	0.630	100.0	---
Cadmium, Leachable (Cd)	0.0070	0.0300	0.0430	0.0210	0.0070	0.0420	0.0370	0.0450	0.0270	1.0	0.066
Chromium, Leachable (Cr)	0.198	0.626	0.616	0.626	0.271	0.605	0.648	0.622	0.648	5.0	5.2
Lead, Leachable (Pb)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	5.0	0.51
Mercury, Leachable (Hg)	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	0.2	---
Selenium, Leachable (Se)	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	1.0	---
Silver, Leachable (Ag)	0.0030	0.0190	0.0210	0.0140	0.0030	0.0210	0.0200	0.0200	0.0160	5.0	0.072
Nickel, Leachable (Ni)	<0.03	0.0860	0.270	0.0400	<0.03	0.293	0.200	0.264	0.0450	---	0.32
pH after TCLP extraction	11.9	8.0	7.1	9.7	12.1	7.1	7.6	7.2	8.8	---	---

TABLE 4-4

UCS RESULTS (psi)
207C - LIME/CEMENT/FLYASH + SODIUM SILICATE

Mix	48 Hr.*	7-Day	7-Day (Dup.)	14-Day	28-Day
Batch 1	612	>637	236	>637	>637
Batch 2	>631	>637	>637	>637	>637
Batch 3	393	587	387	443	461
Batch 4	412	>637	>637	>637	506
Batch 5	486	>637	>637	>637	>637
Batch 6	448	>637	395	>637	602
Batch 7	>625	>637	>637	>637	>637
Batch 8	278	197	344	623	461
Batch 9	310	505	539	>637	442

* Accelerated Cure
Dup. - Duplicate

TABLE 4-5

207C SLURRY WITH LIME/CEMENT/FLYASH/SILICATE DURABILITY TEST RESULTS

	UCS Before Durability Testing (psi)	FREEZE/THAW		WET/DRY	
		% Wt. Loss	UCS After Durability Test (psi)	% Wt. Loss	UCS After Durability Test (psi)
Batch 1	612	25	160	24	>637
Batch 2	>631	20	>637	21	>637
Batch 3	393	33	275	37	73
Batch 4	412	25	457	27	405
Batch 5	486	26	258	27	613
Batch 6	448	25	347	26	361
Batch 7	>625	24	>637	22	>637
Batch 8	278	41	115	--	Failed in cycle
Batch 9	310	28	350	31	241

NOTE: All cylinders passed the required 12 cycles for the durability test unless otherwise noted.

All testing was performed on 48-hour accelerated cure samples.

% weight loss is approximated and is a combination of any moisture loss plus mass lost as a result of the brushing after each cycle.

5.0 STABILIZATION OF POND 207C LIME/CEMENT/FLYASH + LATEX 2000 SYSTEM

5.1 INITIAL MIXES

5.1.1 Purpose

The purpose of this series of tests is to analyze the effect of adding the Latex 2000 system to the previously established mixtures of lime/cement/flyash, further utilizing factorial experimentation (3x2). This experiment is conceptually illustrated in Figure 5-1. The Latex 2000 system uses Latex 2000, Stabilizer 434B, and D-AIR 3 to encapsulate the cement matrix. The addition of these latex and surfactant additives should provide additional durability to the cylinders.

5.1.2 Procedure

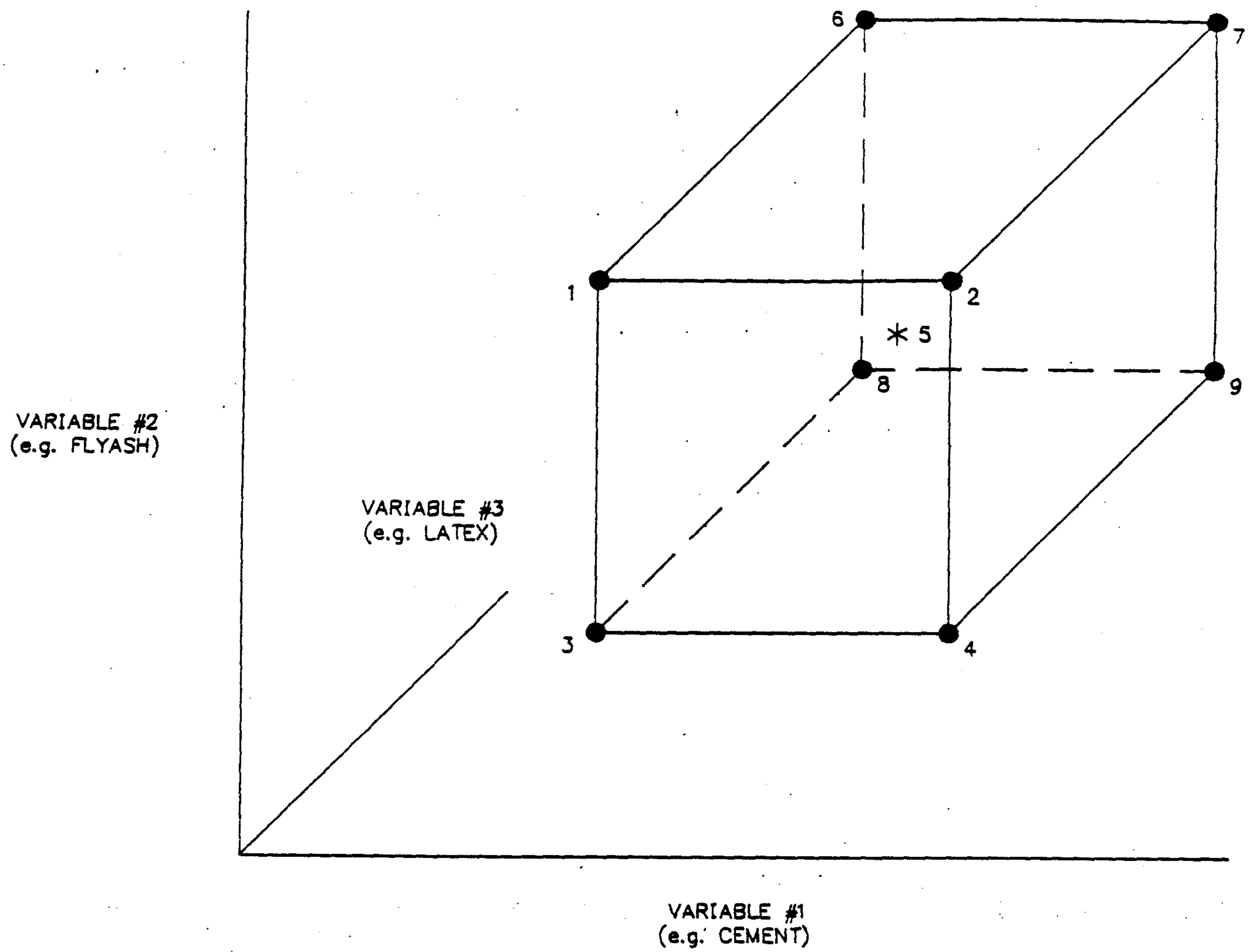
Initially a sludge mixture was made using 5 parts pond water, 1 part crystal, and 1 part underlying sludge (by volume). This ratio of the "sludge mixture" was held constant for all 9 batches. The batches that were mixed are defined in Table 5-1 with Batch #5 being the previously defined center point.

Hydrated lime was used to achieve a pH of 11.5 to 12 in the sludge mixture. After the pH adjustment, the Latex 2000 system was added in the following order: D-AIR 3, Stabilizer 434B, and Latex 2000. Next the Type V cement and Type C "comanche" flyash was added. The mixture was wet mixed for 5 min.

The mixtures incorporated the Latex 2000 at 5% to 15% by weight of the cement in the mixture. Stabilizer 434B was added at 15%, and D-AIR 3 at 4%, of the Latex 2000.

Eight cylinders were made for each batch. After curing, products were tested for UCS using ASTM Method C39-86. TCLP extraction and metals analysis were also conducted. The freeze/thaw and wet/dry durability test procedures were modified to enable the testing to be completed prior to the start of the final phase. The control cylinder (i.e., volume and moisture loss specimen) was omitted, thus only one cylinder was submitted for each test. The dimension measurements and the weighing of the cylinders were also omitted. Brushing of the cylinders was done as specified int he methods. The freeze/thaw procedure was accelerated by reducing the time of freezing from 25 hours/cycle to 12 hours/cycle. The wet/dry procedure was accelerated by decreasing the drying period from 42 hours to 19 hours and the time of submergence from 5 hours to 4 hours.

FIGURE 5-1



LEGEND

* CENTER POINT CONCENTRATION

● CONCENTRATIONS ± %
AROUND CENTER POINT

ACAD: 2K68\3VAR(LATEX) 2/8/92

TABLE 5-1

BATCHES FOR 207C STABILIZATION
LIME/CEMENT/FLY ASH + LATEX 2000 SYSTEM

	Sludge Mixture	Cement	Flyash	Latex 2000	Stabilizer 434B	D-Air 3
Batch 1	2000g	625g	2084g	32.00g	5.00g	1.00g
Batch 2	2000g	1041g	2084g	52.00g	8.00g	2.00g
Batch 3	2000g	625g	1250g	32.00g	5.00g	1.00g
Batch 4	2000g	1041g	1250g	52.00g	8.00g	2.00g
Batch 5	2000g	833g	1667g	83.00g	13.00g	3.70g
Batch 6	2000g	625g	2084g	94.00g	15.00g	4.20g
Batch 7	2000g	1041g	2084g	156.00g	25.00g	7.00g
Batch 8	2000g	625g	1250g	94.00g	15.00g	4.20g
Batch 9	2000g	1041g	1250g	156.00g	25.00g	7.00g

TABLE 5-2

SUMMARY OF TESTING SCHEDULE
207C - LIME/CEMENT/FLYASH + LATEX 2000 SYSTEM

Curing Time	UCS	TCLP (Metals)	Freeze/Thaw + UCS	Wet/Dry + UCS
48 hrs*	1	1	1	1
7-day	2	NA	NA	NA
14-day	1	NA	NA	NA
28-day	1	NA	NA	NA

*Accelerated Cure

Table 5-2 defines curing times and the cylinders required for each test.

5.1.3 Results

Table 5-3 summarizes the TCLP metals data for the 48-hour accelerated cure samples. All samples passed TCLP requirements for the LDRs and the characteristic of toxicity.

Table 5-4 summarizes all available UCS data (28-day regular cure data are not yet available. The data suggests a slight deterioration of UCS at 15% latex vs. 5% latex, when comparing Batches 8 and 9 to Batches 3 and 4. When data on Table 5-4 are compared to Table 2-4, to evaluate the mixes with and without the Latex 2000 system, no clear conclusions can be drawn. It appears that the addition of Latex 2000 helped Batch 3, but hurt Batches 5 and 9.

Table 5-5 summarizes the durability test data. Only Batch 2 retained its original UCS after freeze/thaw testing. The high flyash batches (1, 2, 6 and 7) plus Batch 4 retained their UCS after wet/dry testing. When data on table 5-5 are compared to Table 2-5, more than half the test cylinders showed decreased UCS values after testing. This effect was more pronounced after the freeze/thaw testing.

TABLE 5-3

48 hr ACCELERATED CURE TCLP RESULTS (mg/L)
207C - LIME/CEMENT/FLYASH + LATEX 2000 SYSTEM

ANALYTE	BATCH #1	BATCH #2	BATCH #3	BATCH #4	BATCH #5	BATCH #6	BATCH #7	BATCH #8	BATCH #9	TOXICITY CHARACTER -ISTIC STANDARD	NONWASTE -WATER LDR STANDARD
Arsenic, Leachable (As)	0.118	0.0860	0.149	0.139	0.111	0.159	0.149	0.117	0.125	5.0	---
Barium, Leachable (Ba)	0.663	0.461	0.432	0.411	0.486	0.698	0.465	0.603	0.426	100.0	---
Cadmium, Leachable (Cd)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	1.0	0.066
Chromium, Leachable (Cr)	0.417	0.424	0.480	0.478	0.434	0.425	0.438	0.441	0.470	5.0	5.2
Lead, Leachable (Pb)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	5.0	0.51
Mercury, Leachable (Hg)	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	0.2	---
Selenium, Leachable (Se)	<0.08	<0.08	<0.08	<0.08	<0.08	0.165	0.104	0.0900	<0.08	1.0	---
Silver, Leachable (Ag)	<0.003	<0.003	<0.003	0.0040	<0.003	<0.003	<0.003	<0.003	<0.003	5.0	0.072
Nickel, Leachable (Ni)	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	---	0.32
pH after TCLP extraction	9.9	9.8	10.4	10.7	9.9	9.6	10.3	9.9	11.0	---	---

TBLE 5-4

UCS RESULTS (psi)
207C - LIME/CEMENT/FLYASH + LATEX 2000 SYSTEM

Mix	48 Hr.*	7-Day	7-Day (Dup.)	14-Day	28 Day
Batch 1	>625	>637	>637	>637	>637
Batch 2	>630	>637	>637	>637	>637
Batch 3	568	>637	265	>637	378
Batch 4	>631	>637	>637	>637	635
Batch 5	>625	>637	239	535	399
Batch 6	>625	>637	>637	>637	>637
Batch 7	>631	>637	>637	>637	>637
Batch 8	503	92	316	498	336
Batch 9	>625	320	586	278	485

* Accelerated Cure
Dup. - Duplicate

TABLE 5-5

207C SLURRY WITH LIME/CEMENT/FLYASH/LATEX 2000 SYSTEM
DURABILITY TEST RESULTS

		FREEZE/THAW		WET/DRY	
	UCS Before Durability Testing (psi)	% Wt. Loss	UCS After Durability Test (psi)	% Wt. Loss	UCS After Durability Test (psi)
Batch 1	>625	26	421	21	>637
Batch 2	>630	20	>637	15	>637
Batch 3	568	23	112	33	416
Batch 4	>631	29	295	20	>637
Batch 5	>625	37	160	21	252
Batch 6	>625	25	508	18	>637
Batch 7	>631	23	152	14	>637
Batch 8	503	39	117	25	593
Batch 9	>625	32	261	20	535

NOTE: All cylinders passed the required 12 cycles for the durability test unless otherwise noted.

All testing was performed on 48-hour accelerated cure samples.

% weight loss is approximated and is a combination of any moisture loss plus mass lost as a result of the brushing after each cycle.

5.2 SUPPLEMENTAL MIXES

5.2.1 Purpose

Additional mixes were prepared to expand the range of the Latex 2000 system used in the factorial experiments.

5.2.2 Procedure

Initially, a sludge mixture was made using 5 parts pond water, 1 part crystal and 1 part underlying sludge (by volume). This ratio of the "sludge mixture" was held constant for both batches. The batches that were mixed are defined in Table 5-6.

Hydrated lime was used to achieve a pH of 11.5 to 12 in the sludge mixture. After the pH adjustment, the Latex 2000 system was added in the following order: D-AIR 3, Stabilizer 434B, and Latex 2000. Next, the Type V cement and Type C "pawnee" flyash were added. The mixture was wet mixed for 5 min.

The mixtures incorporate the Latex 2000 at 50% and 100% by weight of the cement in the mixture. Stabilizer 434B was added at 15%, and D-AIR 3 at 4%, of the Latex 2000.

Three cylinders were made for each batch. After accelerated curing, specimens were tested for UCS using ASTM Method C39-86. The freeze/thaw and wet/dry durability test procedures were modified to enable the testing to be completed prior to the start of the final phase. The control cylinder (i.e., volume and moisture loss specimen) was omitted, thus only one cylinder was submitted for each test. The dimension measurements and the weighing of the cylinders were also omitted. Brushing of the cylinders was done as specified in the methods. The freeze/thaw procedure was accelerated by reducing the time of freezing from 24 hours/cycle to 12 hours/cycle. The wet/dry procedure was accelerated by decreasing the drying period from 42 hours to 19 hours and the time of submergence from 5 hours to 4 hours. Table 5-7 defines curing times and the cylinders required for each test.

5.2.3 Results

Neither of the supplemental batches solidified. The obvious conclusion is that the high dosages of Latex 2000 System used retarded the cement.

TABLE 5-6

SUPPLEMENTAL BATCHES FOR STABILIZATION
LIME/CEMENT/FLYASH + LATEX 2000 SYSTEM

	Sludge Mixture	Cement	Flyash	Latex 2000	Stabilizer 434B	D-Air 3
Batch 1	800g	333g	667g	166g	26.00g	6.50g
Batch 2	800g	333g	667g	333g	52.00g	13.00

TABLE 5-7

SUPPLEMENTAL LATEX 2000 SYSTEM TESTING SCHEDULE

Curing Time	UCS	TCLP (Metals)	Freeze/Thaw + UCS	Wet/Dry + UCS
48 hrs*	1	NA	1	1
7-day	NA	NA	NA	NA
14-day	NA	NA	NA	NA
28-day	NA	NA	NA	NA

* Accelerated Cure
NA - Not Analyzed

6.0 STABILIZATION OF POND 207C LIME/CEMENT/FLYASH + HR-25

6.1 PURPOSE

The purpose of this series of tests is to analyze the effect of adding the HR-25 to the previously established mixtures of lime/cement/flyash, further utilizing factorial experimentation (3x2). This experiment is conceptually illustrated in Figure 6-1. HALLIBURTON SERVICE'S HR-25 is an additive for the control of efflorescence in salt solutions. HR-25 is also a cement retarder. The effect on strength, durability, and TCLP leachability of previously tested mixes was monitored.

6.2 PROCEDURE

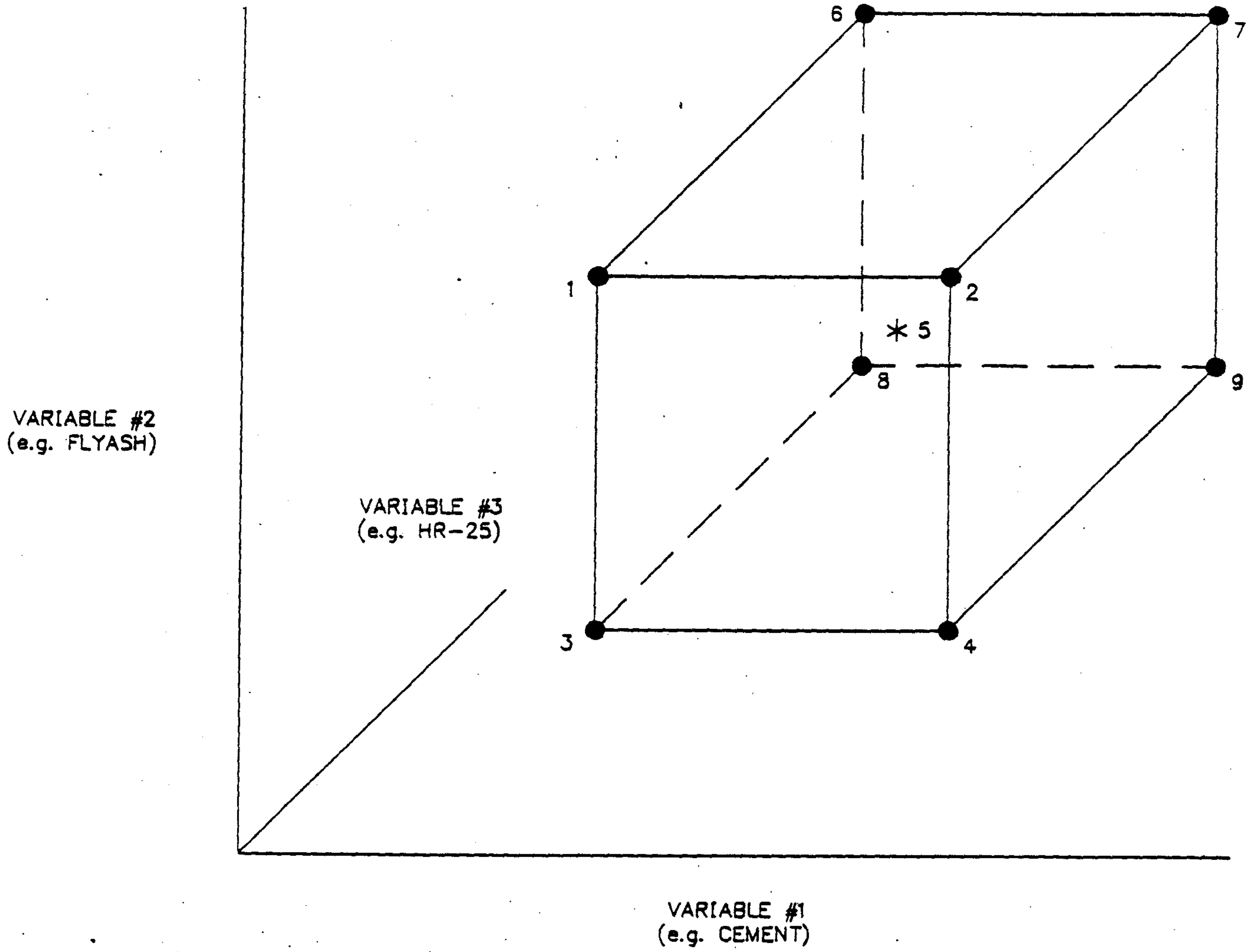
Initially, a sludge mixture was made using 5 parts pond water, 1 part crystal and 1 part underlying sludge (by volume). This ratio of the "sludge mixture" was held constant for all 9 batches. The batches that were mixed are defined in Table 6-1 with Batch #5 being the previously defined center point.

Hydrated lime was used to achieve a pH of 11.5 to 12 for the sludge mixture. After the pH adjustment, the HR-25, Type V cement and Type C "comanche" flyash was added. The mixture was wet mixed for 5 minutes.

The mixtures incorporated the HR-25 at a range of 20.00g to 40.00g.

Eight cylinders were made for each batch. After curing, cylinders were tested for UCS using ASTM Method C39-86. TCLP extraction and metals analysis were also conducted. The freeze/thaw and wet/dry durability test procedures were modified to enable some of the testing to be completed prior to the start of the final phase. The control cylinder (i.e., volume and moisture loss specimen) was omitted, thus only one cylinder was submitted for each test. The dimension measurements and the weighing of the cylinders were omitted. Brushing of the cylinders were done as specified in the methods. The freeze/thaw procedure was accelerated by reducing the time of freezing from 24 hours/cycle to 12 hours/cycle. The wet/dry procedure was accelerated by decreasing the drying period from 42 hours to 19 hours and the time of submergence from 5 hours to 4 hours. Using these accelerated methods, testing was completed in time to incorporate the results in the final phase. Table 6-2 defines curing times and the cylinders required for each test.

FIGURE 6-1



LEGEND

* CENTER POINT CONCENTRATION

● CONCENTRATIONS ± %
AROUND CENTER POINT

CAD: 2K68\3VAR(HR25) 2/6/92

TABLE 6-1

BATCHES FOR 207C STABILIZATION
LIME/CEMENT/FLYASH + HR-25 ADDITIVE

	Sludge Mixture	Cement	Flyash	HR-25
Batch 1	2000g	625g	2084g	20.00g
Batch 2	2000g	1041g	2084g	20.00g
Batch 3	2000g	625g	1250g	20.00g
Batch 4	2000g	1041g	1250g	20.00g
Batch 5	2000g	833g	1667g	30.00g
Batch 6	2000g	625g	2084g	40.00g
Batch 7	2000g	1041g	2084g	40.00g
Batch 8	2000g	625g	1250g	40.00g
Batch 9	2000g	1041g	1250g	40.00g

NOTE: Batches 8 and 9 were omitted due to an insufficient amount of the sludge mixture.

TABLE 6-2

SUMMARY OF TESTING SCHEDULE
207C - LIME/CEMENT/FLYASH + HR-25

Curing Time	UCS	TCLP (Metals)	Freeze/Thaw + UCS	Wet/Dry + UCS
48 hrs*	1	1	1	1
7-day	2	NA	NA	NA
14-day	1	NA	NA	NA
28-day	1	NA	NA	NA

* Accelerated Cure
NA - Not analyzed

6.3 RESULTS

Only Batches 1 and 2 hardened after the 48-hour accelerated cure. No TCLP data is available for these mixes because of error in conducting the TCLP Extraction. The error resulted in the analytical results being inaccurate.

Upon receiving the results, discussions with the laboratory determined that the laboratory technician was adding more acetic acid to prepare the extraction fluid then what was required by the method. The TCLP method indicates that 5.7 ml of acid should be used in preparing the extraction fluid. The technician was adding additional acid to achieve a pH of approximately 2.88 which is incorrect. The method states that the extraction fluid should be discarded if the pH is not correct (2.88 +/- 0.05 Standard Units). The additional acid in the extraction fluid resulted in the pH of the leachate being lower than if the proper amount of acid was added. Because the pH was decreased to approximately 5.0 in the leachate, the metals became more soluble resulting in leachate concentrations above the LDR standards.

Table 6-3 summarizes available UCS data (28-day cure data not yet available). Only Batches 1 and 2 hardened after the accelerated cure. These batches represented the lowest HR-25 concentrations but the highest flyash concentrations. Under normal cure conditions, only Batches 2 and 5 reached the maximum level on the machine. Batch 2 corresponds to the highest flyash and cement concentrations, but the lowest HR-25 concentration. Batch 5 is the center point comparison of data on Table 6-3 with data on Table 2-4 shows the retarding effect of the HR-25.

None of the cylinders have failed through 11 cycles of the accelerated durability tests. Final weight loss and UCS data are not yet available.

TABLE 6-3

UCS RESULTS (psi)
207C -LIME/CEMENT/FLYASH + HR-25

Mix	48 Hr.*	7-Day	7-Day (Dup.)	14-Day	28-Day
Batch 1	287	261	285	441	>637
Batch 2	>637	630	>637	>637	412
Batch 3	TSTT	17	14	19	465
Batch 4	TSTT	224	217	281	606
Batch 5	TSTT	(1)	(1)	>637	298
Batch 6	TSTT	10	(1)	(1)	207
Batch 7	TSTT	58	20	64	>637
Batch 8	ND	ND	ND	ND	ND
Batch 9	ND	ND	ND	ND	ND

(1) Sample broke in half when removed from mold

* Accelerated Cure
TSTT - Too Soft To Test
ND - No data; batch not mixed
Dup. - Duplicate

7.0 STABILIZATION OF POND 207C LIME/CEMENT/FLYASH + HR-4

7.1 PURPOSE

The purpose of this series of tests is to analyze the effect of adding HR-4 to the previously established mixtures of lime/cement/flyash, further utilizing factorial experimentation (3x2). This experiment is conceptually illustrated in Figure 7-1. HALLIBURTON SERVICE'S HR-4 is an additive for the control of efflorescence in salt solutions. HR-4 is also a cement retarder. The effect on strength, durability and TCLP leachability of previously tested mixes was monitored.

7.2 PROCEDURE

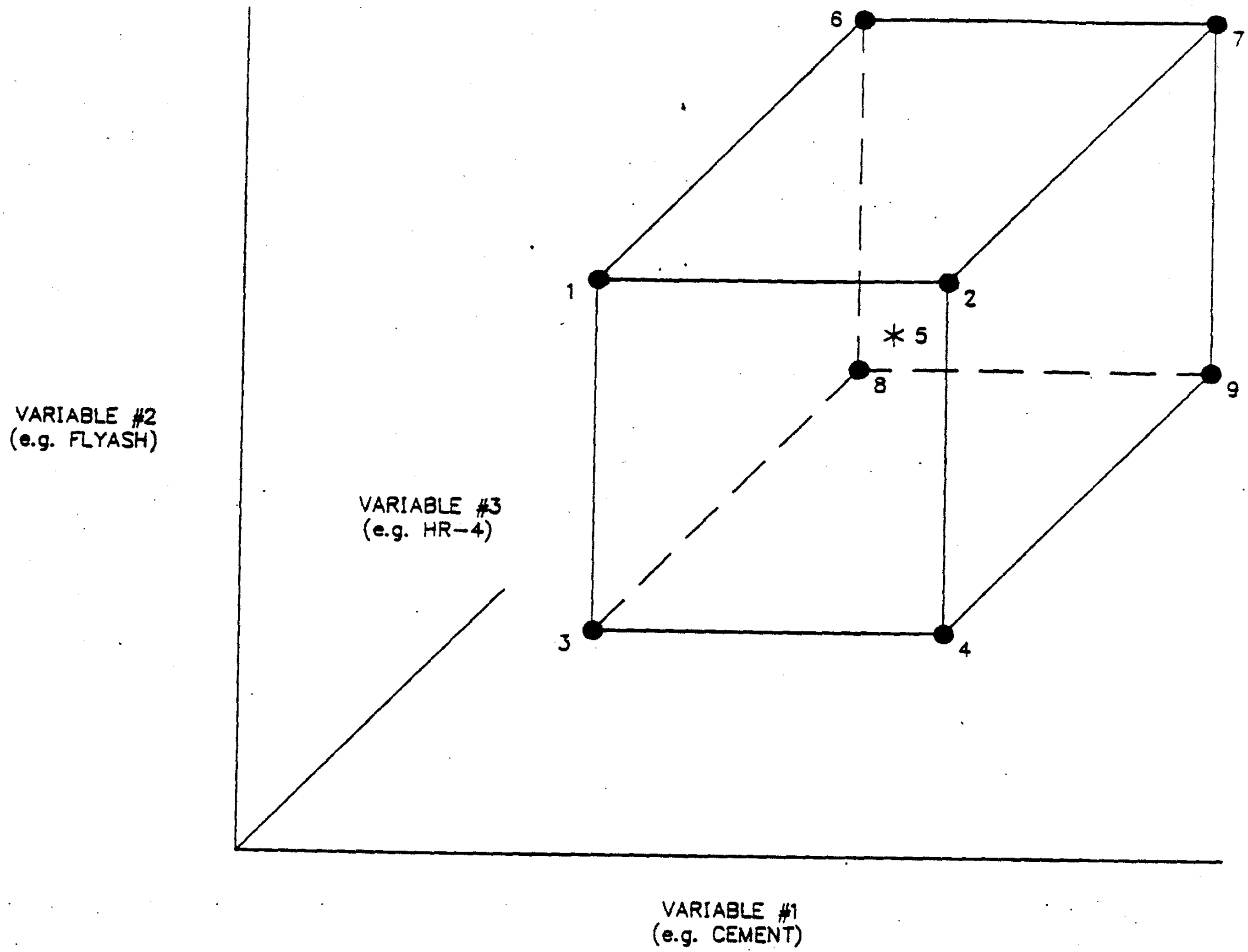
Initially, a sludge mixture was made using 5 parts pond water, 1 part crystal, and 1 part underlying sludge (by volume). This ratio of the "sludge mixture" was held constant for all 9 batches. The batches that were mixed are defined in Table 7-1 with batch #5 being the previously defined center point.

Hydrated lime was used to achieve a pH of 11.5 to 12 in the sludge mixture. After the pH adjustment, the HR-4, Type V cement, and Type C "comanche" flyash was added. The mixture was wet mixed for 5 minutes.

The mixtures incorporated the HR-4 at a range of 20.00g to 40.00g.

Eight cylinders were made for each batch. After curing, products were tested for UCS using ASTM Method C39-86. TCLP extraction and metals analysis were also conducted. The freeze/thaw and wet/dry durability test procedures were modified to enable some of the testing to be completed prior to the start of the final phase. The control cylinder (i.e., volume and moisture loss specimen) was omitted, thus only one cylinder was submitted for each test. The dimension measurements and the weighing of the cylinders were omitted. Brushing of the cylinders was done as specified in the methods. The freeze/thaw procedure was accelerated by reducing the time of freezing from 24 hours/cycle to 12 hours/cycle. The wet/dry procedure was accelerated by decreasing the drying period from 42 hours to 19 hours and the time of submergence from 5 hours to 4 hours. Using these accelerated methods, testing was completed in time to incorporate the results in the final phase. Table 7-2 defines curing times and the cylinders required for each test.

FIGURE 7-1



LEGEND

* CENTER POINT CONCENTRATION

● CONCENTRATIONS ± %
AROUND CENTER POINT

TABLE 7-1

BATCHES FOR 207C STABILIZATION
LIME/CEMENT/FLYASH + HR-25 ADDITIVE

	Sludge Mixture	Cement	Flyash	HR-4
Batch 1	2000g	625g	2084g	20.00g
Batch 2	2000g	1041g	2084g	20.00g
Batch 3	2000g	625g	1250g	20.00g
Batch 4	2000g	1041g	1250g	20.00g
Batch 5	2000g	833g	1667g	30.00g
Batch 6	2000g	625g	2084g	40.00g
Batch 7	2000g	1041g	2084g	40.00g
Batch 8	2000g	625g	1250g	40.00g
Batch 9	2000g	1041g	1250g	40.00g

NOTE: Batches 1 and 9 were omitted due to an insufficient amount of the sludge mixture.

TABLE 7-2

SUMMARY OF TESTING SCHEDULE
207C - LIME/CEMENT/FLYASH + HR-4

Curing Time	UCS	TCLP (Metals)	Freeze/Thaw + UCS	Wet/Dry + UCS
48 hrs*	1	1	1	1
7-day	2	NA	NA	NA
14-day	1	NA	NA	NA
28-day	1	NA	NA	NA

* Accelerated Cure
NA - Not Analyzed

7.3 RESULTS

Only Batches 2, 3, and 4 solidified after accelerated curing. No TCLP data is available for these mixes because of error in conducting the TCLP Extraction. The error resulted in the analytical results being inaccurate.

Upon receiving the results, discussions with the laboratory determined that the laboratory technician was adding more acetic acid to prepare the extraction fluid then what was required by the method. The TCLP method indicates that 5.7 ml of acid should be used in preparing the extraction fluid. The technician was adding additional acid to achieve a pH of approximately 2.88 which is incorrect. The method states that the extraction fluid should be discarded if the pH is not correct (2.88 +/- 0.05 Standard Units). The additional acid in the extraction fluid resulted in the pH of the leachate being lower then if the proper amount of acid was added. Because the pH was decreased to approximately 5.0 in the leachate, the metals became more soluble resulting in leachate concentrations above the LDR standards.

Table 7-3 summarizes available UCS data (28-day regular cure day cure are not yet available). The data clearly show the retarding effect of the HR-4 additive. Only Batches 2, 4, 5, and 7 achieved the maximum UCS reading after 14-day regular curing. Batches 2, 4, and 7 correspond to the maximum cement dosages, while Batch 5 is the center point.

Final durability test results are not yet available for the three accelerated cure batches. All of the cylinders are sill intact through 11 cycles. It was noted during mixing that the HR-4 resisted complete mixing with the sludge.

TABLE 7-3

UCS RESULTS (psi)
207C - LIME/CEMENT/FLYASH + HR-4

Mix	48 Hr.*	7-Day	7-Day (Dup.)	14-Day	28-Day
Batch 1	ND	ND	ND	ND	ND
Batch 2	>637	>637	>637	>637	>637
Batch 3	>637	395	476	105	>637
Batch 4	424	>637	625	>637	>637
Batch 5	TSTT	270	248	>637	>637
Batch 6	TSTT	TSTT	TSTT	527	>637
Batch 7	TSTT	>637	>637	>637	>637
Batch 8	TSTT	TSTT	TSTT	(1)	TSTT
Batch 9	ND	ND	ND	ND	ND

(1) Sample broke in half when removed from mold.

* Accelerated Cure
TSTT - Too Soft To Test
ND - No data; batch not mixed
Dup. - Duplicate

8.0 CONCLUSIONS AND RECOMMENDATIONS

Following is a summary of the major conclusions as a result of the 207C treatability testing to date:

- The results of TCLP testing clearly verify the sensitivity of leaching to the pH of the leach solution. A pH of 9 or greater in the leach solution must be maintained to assure compliance with LDR standards.

- No other additives, such as ferrous sulfate, appear to be necessary to achieve desired TCLP results.

- Mixes of lime/cement/flyash appear capable of meeting all stabilization objectives.

- The addition of plastic fibers did not show any benefits as far as strength or durability.

- The addition of sodium silicate did not show any benefits as far as strength or durability.

- Results of the Latex 2000 system are not conclusive and will require further discussion.

- The additives HR-4 and HR-25 retarded the solidification of the mixes. There appear to be no advantages to the inclusion of these additives (this assumes that efflorescence, which has not been noticed to date, will not be a long-term problem).

- The discoloration of some of the cylinders, which often took a donut shape on the ends of the cylinders, cannot be explained. It is not known whether this is of any long-term significance or is indicative of a physical or chemical process that should be of concern (see photographs in Appendix B).

We recommend the following mixes for the final regulatory confirmation phase:

- Lime/cement/flyash at the previously-established center point, with the factorial adjusted to increase the UCS in Batch 3.

- Lime/cement/flyash + entrained air as a further protection against freeze/thaw damage.

- Lime/cement/flyash + Latex 2000 (at 1%, 3%, and 5%). Further discussion of these concentrations is needed.

- Titration tests will be performed to quantify the amount of lime needed with each additive to assure that the pH of the TCLP extract stays above 9.

TABLE 3-3

48-hr CURE ACCELERATED TCLP RESULTS (mg/L)
207C - LIME/CEMENT/FLYASH + PLASTIC FIBERS

ANALYTE	BATCH #1	BATCH #2	BATCH #3	BATCH #4	BATCH #5	TOXICITY CHARACTERISTIC STANDARD	NONWASTEWATER LDR STANDARD
Arsenic, Leachable (As)	0.130	0.119	0.155	0.155	0.120	5.0	---
Barium, Leachable (Ba)	0.653	0.550	0.540	0.540	0.499	100.0	---
Cadmium, Leachable (Cd)	<0.005	<0.005	<0.005	<0.005	<0.005	1.0	0.066
Chromium, Leachable (Cr)	0.352	0.391	0.373	0.373	0.416	5.0	5.2
Lead, Leachable (Pb)	<0.02	<0.02	<0.02	<0.02	<0.02	5.0	0.51
Mercury, Leachable (Hg)	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	0.2	---
Selenium, Leachable (Se)	0.108	0.114	<0.08	<0.08	0.108	1.0	---
Silver, Leachable (Ag)	<0.003	<0.003	<0.003	<0.003	<0.003	5.0	0.072
Nickel, Leachable (Ni)	<0.03	<0.03	<0.03	<0.03	<0.03	---	0.32
pH after TCLP extrn.	10.1	10.2	10.4	10.4	10.5	---	---

ATTACHMENT A

Contents:

ATTACHMENT A-1

**OBSERVATIONS OF PRELIMINARY 207C
TREATABILITY STUDY
(MEMORANDUM FROM T. SNARE TO T. BITTNER)**

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-01-92-57

DATE: JANUARY 20, 1991

TO: TED BITTNER

FROM: TOM SNARE TZS

COPY: RICH NINESTEEL
DONALD BRENNEMAN
SHAJ MATHEW
JOHN ZAK
JERRY CHILDS
FILE 2K68

SUBJECT: OBSERVATIONS FROM PRELIMINARY 207C TREATABILITY STUDY - EG&G ROCKY FLATS STABILIZATION PROJECT REVISION NO. 2 (TEST COMPLETED 1/19/92)

1.0 Purpose

The goal of this testing was to initiate an early study for the solidification of the 207C pond sludge, crystals, and water (i.e., slurry). This slurry was solidified using lime, cement, and flyash, with the second mix adding HALLIBURTON Services Latex 2000 System. The intent is to observe mixing characteristics, establish long term durability of the mixes, and analyze for TCLP constituents for an initial starting point for subsequent testing.

2.0 Procedure

The slurry of 207C pond sludge, crystals and water was solidified using two different mixtures. The first mixture consisted of slurry, lime (to pH 11), Type C flyash and portland type I-II cement. The second mixture was essentially the same except for the addition of the LATEX 2000 System. The LATEX 2000 system included D-AIR 3, stabilizer 434C and LATEX 2000. Solidification mixture ratios are described in Table 2-1. Nine cylinders were filled for both mixtures. The mixing was completed on November 25, 1991.

3.0 Results

<u>BATCH #1</u> - The crystal part of the sludge was ground to a -10 mesh size. The crystals were then combined with the water and sludge to form the slurry. While in this slurry, the crystals visually reformed to a size of +10 mesh. Upon the addition of cement and flyash the crystals dissipated based on the feel of the mix during hand mixing.

After the blending with the HOBART mixer the consistency of the mixture was described as "very runny, but started to set up by the time the last cylinder was poured."

BATCH #2 - After the blending with the HOBART mixer, the consistency of the mixture was described as "thicker than Batch #1 and started to set up during molding." The mixture had to be spooned into the molds.

A visual observation was performed after 5 days of NORMAL curing; both batches were described as being hard. After 24 days of curing, samples from both batches were submitted for UCS, TCLP (metals) and durability tests. The following results were reported:

UCS (ASTM C39-86)	Result
Batch #1	>600 psi
Batch #2	>600 psi

TCLP Preliminary Data

As shown in Table 3-1.

1. Freeze/Thaw (ASTM D560-82)

   The specimens submitted from Batch #1 continued to be cycled with small hair-line cracks appearing as of 1/8/92. The Batch #1 soil-cement loss specimen broke in half at the end of cycle 9 (1/15/92) during the scratch test. The Batch #1 volume and moisture change specimen began crumbling at the end of cycle 10 and failed after cycle 11 (1/19/92). Specimens submitted from Batch #2 both developed cracks and crumbled, and were deemed a failure after 3 cycles on 12/31/91. UCS measurments were to be done on the volume and moisture change specimens from both batches, however since these cylinders failed before the completion of the required 12 cycles this data is not available.

2. Wet/Dry (ASTM D560-82)

   The specimens submitted from Batch #1 started to cracked and crumble after 8 cycles. This deterioration was limited to the outer 1/4" of the cylinders. Both specimens continued to be cycled for the remainder of the test. Samples from Batch #2 were continued for the full 12 cycles.

The UCS measurements taken from the volume and moisture change specimens after 12 cycles are as follows:

	Result
Batch #1	>631 psi
Batch #2	>631 psi

4.0 Conclusions

1. Both batches were within regulatory standards (toxicity characteristic and LDR standards) based on the TCLP results.
2. The addition of the Latex 2000 System enhanced resistance to wet/dry cycling but decreased resistance to freeze/thaw cycling.
3. No efflorescence has been observed to date.
4. Overall results from Batch #1 (lime\cement\flyash) are encouraging. Further testing to establish optimum ratios will be needed.

TLS/pam

TABLE 3-1

TCLP PRELIMINARY DATA (mg/L)

Analyte	Batch #1	Batch #2	Toxicity Characteristic Standard	Nonwastewater LDR Standard
TCLP Leaching Procedure	DONE	DONE	---	---
Arsenic, Leachable (As)	0.42	0.46	5.0	---
Barium, Leachable (Ba)	0.50	0.51	100.0	---
Cadmium, Leachable (Cd)	<0.005	<0.005	1.0	0.066
Chromium, Leachable (Cr)	0.22	0.20E	5.0	5.2
Lead, Leachable (Pb)	<0.02	<0.02	5.0	0.51
Mercury, Leachable (Hg)	<0.00008	<0.00008	0.2	---
Selenium, Leachable (Se)	<0.08	<0.08	1.0	---
Silver, Leachable (Ag)	<0.003	<0.003	5.0	0.072
Nickel, Leachable (Ni)	<0.03	0.03	---	0.32
Iron, Leachable (Fe)	0.014	0.022	---	---
Aluminum, Leachable (Al)	3.6	4.0	---	---
Calcium, Leachable (Ca)	640	590E	---	---
Magnesium, Leachable (Mg)	0.07	0.07	---	---

NOTE: Batch #1 - Final pH of TCLP is 11.7.
Batch #2 - Final pH of TCLP is 11.7. E-Serial dilution result did not agree with the original results within 10%. Matrix interference should be suspected.

TABLE 2-1

SOLIDIFICATION MIXTURE RATIOS

	Batch #1		Batch #2	
	Grams Added	% (by wt.)	Grams Added	% (by wt.)
Pond Water	1430g	35.7	1430g	33.7
Pond Sludge	286g	7.1	286g	6.7
Pond Crystals	286g	7.1	286g	6.7
Lime	to pH 11	---	to pH 12	---
Cement Type I-II	667g	16.7	667g	15.7
Flyash Type C	1334g	33.3	1334g	31.4
Latex 2000	NA	---	200g	4.7
Stabilizer 43B	NA	---	32g	0.75
D-Air-3	NA	---	9g	0.21

NA: Not Added

Preliminary 207C Mixes (Nov. 1991)

	TDS	TSS	TS	Water
1430 g water	658 g	–	–	772
286 g Sludge	74	126		86
286 g Crystal	229			57
				915 g water

*assume 80% TDS

Mix used 667 g cement and 1334 g flyash

$$W/P = 915g/(667+1334)$$

$$= .46$$

HALLIBURTON NUS Environmental Corporation and Subsidiaries

STANDARD CALCULATION SHEET

CLIENT:	FILE NO.:	BY:	PAGE OF
SUBJECT: 207C Preliminary Batches		CHECKED BY:	DATE:

		TDS	TSS	Water	
Pond Water	1430g	657.8	—	772.2	(CR)
Pond Sludge	286g	108	114.5g	63.4	(Templeton data)
Pond Crystals	286g	200.0		86	(Assume 70% solids)
				921.6 g	

water = 921.6 g

Pozzolans = 667 g cement + 1334 g flyash = 2001 g

water / Pozzolan Ratio = 921.6/2001 = .46

ATTACHMENT A-2

TECHNICAL MEMORANDUM
207C STABILIZATION RESULTS
FROM INITIAL PHASE OF TESTING

TECHNICAL MEMORANDUM

207C STABILIZATION RESULTS

FROM INITIAL PHASES OF TESTING

Prepared By:

HALLIBURTON NUS ENVIRONMENTAL CORPORATION

REVISION 1

JUNE 1992

1.0 INTRODUCTION

The purpose of this report is to summarize the results of 207C treatability studies to date, and to use this data to select the batches for the final phase of regulatory testing. Because of the schedule limitations and the limited sample of 207C sludge/water/crystals remaining, the data must be thoroughly evaluated and a decision quickly made.

Preliminary testing began in November 1991. The results of this testing, which involved testing mixes with lime/flyash/cement, showed that the mixes tested could meet TCLP requirements, reach relatively high UCS levels, and withstand the majority of wet/dry and freeze/thaw durability cycles (See Appendix A). Therefore, the focus of additional testing was to achieve better durability results.

The testing summarized in this report include the following mixes:

- Lime/cement/flyash
- Lime/cement/flyash + plastic fibers
- Lime/cement/flyash + sodium silicate
- Lime/cement/flyash + Latex 2000 system
- Lime/cement/flyash + HR-25
- Lime/cement/flyash + HR-4

It should be noted that the testing involved accelerated 48-hour cures, as well as accelerated freeze/thaw and wet/dry testing. Therefore, there is always the possibility that the results from the final phase, which will involve full testing, might differ due to the modifications employed.

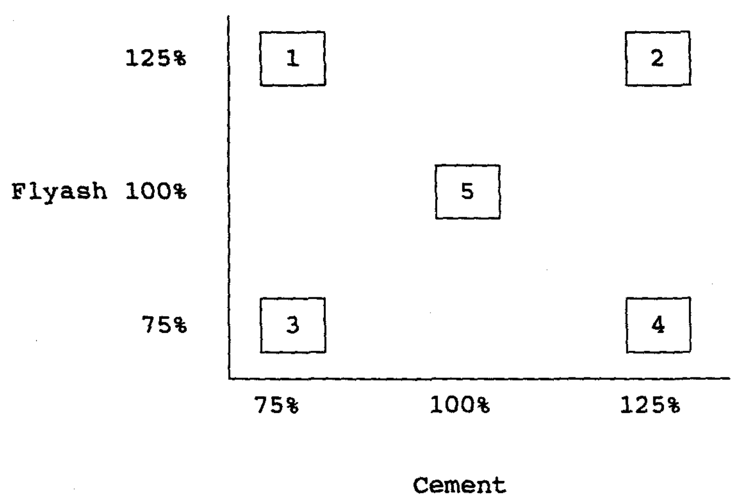
2.0 STABILIZATION OF POND 207C - LIME/CEMENT/FLYASH

2.1 PURPOSE

The purpose of this series of tests was to define baseline ratios of cement (Type V) and flyash (Type C) utilizing factorial experimentation (2x2) around a previously defined center point. This experiment is conceptually illustrated in Figure 2-1. Results from preliminary stabilization tests of Pond 207C indicate UCS and TCLP criteria can be met, therefore, the emphasis of this testing was increased durability (i.e. freeze/thaw and wet/dry). Also, this testing should provide a baseline ratio of cement/flyash to which additives can be incorporated to inhibit unfavorable phenomena which may occur (i.e. efflorescence, crystal growth).

FIGURE 2-1

FACTORIAL EXPERIMENT OF CEMENT/FLYASH RATIOS



2.2 PROCEDURE

Initially a sludge mixture was made using 5 parts pond water, 1 part crystal, and 1 part underlying sludge (by volume). This ratio of the "sludge mixture" was held constant for all 5 batches. The batches that were mixed are defined in Table 2-1 with Batch #5 being the previously defined center point.

Hydrated lime was used to achieve an initial pH of 11.5 to 12 for the sludge mixture. Following the pH adjustment, Type V cement and Type C "pawnee" flyash were added. The mixtures were wet mixed for 5 minutes.

Eight cylinders were made for each batch. After curing, products were tested for UCS using ASTM Method C39-86. TCLP extraction and metals analysis were also conducted on the accelerated cure cylinders. The freeze/thaw and wet/dry durability test procedures were modified to enable the testing to be completed prior to the start of the final phase. The control cylinder (i.e. volume and moisture loss specimen) was omitted, thus only one cylinder was submitted for each test. The dimension measurements and the weighing of the cylinders were also omitted. Brushing of the cylinders was as specified in the methods. The freeze/thaw procedure was accelerated by reducing the time of freezing from 24 hours/cycle to 12 hours/cycle. The wet/dry procedure was accelerated by decreasing the drying period from 42 hours to 19 hours and the time of submergence from 5 hours to 4 hours. Table 2-2 defines curing times and the cylinders required for each test.

TABLE 2-1

BATCHES FOR 207C STABILIZATION - LIME/CEMENT/FLYASH

	Sludge Mixture	Cement	Flyash
Batch 1	2000g	625g	2084g
Batch 2	2000g	1041g	2084g
Batch 3	2000g	625g	1250g
Batch 4	2000g	1041g	1250g
Batch 5	2000g	833g	1667g

TABLE 2-2

SUMMARY OF TESTING SCHEDULE
207C - LIME/CEMENT/FLYASH

Curing Time	UCS	TCLP (Metals)	Freeze/Thaw + UCS	Wet/Dry + UCS
48 hrs*	1	1	1	1
7-day	2	NA	NA	NA
14-day	1	NA	NA	NA
28-day	1	NA	NA	NA

* Accelerated Cure
NA - Not Analyzed

2.3 RESULTS

Table 2-3 summarizes the TCLP metals data for the 48-hour accelerated cure samples. All samples were below LDR and toxicity characteristic standards. It should be noted that lower pH in the TCLP extract (Batches 1 and 3) resulted in higher leachate values of cadmium and nickel, clearly showing the dependency on pH adjustment to pass the TCLP test.

Table 2-4 summarizes all available UCS data (28-day regular cure data are not yet available). As can be seen, all but Batch 3 (lowest flyash and cement dosages) achieved close to or greater than 600 psi after 7 days of regular curing, and all reached this level after 14 days. The maximum UCS that can be determined with the laboratory equipment is approximately 600 psi. All accelerated cures achieved >500 psi UCS.

Table 2-5 summarizes durability data from the freeze/thaw and wet/dry tests performed on the accelerated cure cylinders. The weight loss is approximate because the initial weight for the durability test cylinders was obtained from the one cylinder following 48-hour accelerated cure that was tested for UCS, not the actual durability test cylinders. It was assumed that all cylinders following the accelerated cure have approximately the same weight.

As expected, Batch 3, with the lowest concentrations of cement and flyash, showed the greatest weight loss and the lowest UCS following both durability tests. Batch 2, with the highest cement and flyash concentrations, performed the best. After the freeze/thaw cycling, Batch 1 showed a better UCS than Batch 4, possibly indicating that the total weight of pozzolans (cement + flyash) is an important factor in predicting performance.

TABLE 2-3

48-hr ACCELERATED CURE TCLP RESULTS (mg/L)
207C - LIME/CEMENT/FLYASH

ANALYTE	BATCH #1	BATCH #2	BATCH #3	BATCH #4	BATCH #5	TOXICITY CHARACTERISTIC STANDARD	NONWASTEWATER LDR STANDARD
Arsenic, Leachable (As)	0.123	0.176	0.193	0.160	0.293	5.0	---
Barium, Leachable (Ba)	0.663	0.664	0.667	0.562	0.421	100.0	---
Cadmium, Leachable (Cd)	0.0550	0.0290	0.0320	0.0190	0.0050	1.0	0.066
Chromium, Leachable (Cr)	0.519	0.592	0.575	0.576	0.203	5.0	5.2
Lead, Leachable (Pb)	<0.02	<0.02	<0.02	<0.02	<0.02	5.0	0.51
Mercury, Leachable (Hg)	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	0.2	---
Selenium, Leachable (Se)	<0.08	<0.08	<0.08	<0.08	<0.08	1.0	---
Silver, Leachable (Ag)	0.0190	0.0170	0.0180	0.0130	<0.003	5.0	0.072
Nickel, Leachable (Ni)	0.252	0.0310	0.137	<0.03	<0.03	---	0.32
pH after TCLP extraction	6.9	8.6	7.5	9.7	12.1	---	---

TABLE 2-4

UCS RESULTS (psi)
207C - LIME/CEMENT/FLYASH

Mix	48 Hr.*	7-Day	7-Day (Dup.)	14-Day	28-Day
Batch 1	>631	>637	>637	>637	>637
Batch 2	>631	>637	>637	>637	>637
Batch 3	>631	92.0	55.1	568	437
Batch 4	578	>637	>637	>637	>637
Batch 5	>631	>637	>637	>637	568

* Accelerated Cure
Dup. - Duplicate cylinder

TABLE 2-5

207C SLURRY WITH LIME/CEMENT/FLYASH
DURABILITY TEST RESULTS

	UCS Before Durability Testing (psi)	FREEZE/THAW		WET/DRY	
		% Wt. Loss	UCS After Durability Test (psi)	% Wt. Loss	UCS After Durability Test (psi)
Batch 1	>631	23	>637	24	>637
Batch 2	>631	19	>637	17	>637
Batch 3	>631	29	325	32	531
Batch 4	578	24	561	27	>637
Batch 5	>631	23	421	25	560

NOTE: All cylinders passed the required 12 cycles for the durability test unless otherwise noted.

All testing was performed on 48-hour accelerated cure samples.

% weight loss is approximated and is a combination of any moisture loss plus mass loss as a result of the brushing after each cycle.

3.0 STABILIZATION OF POND 207C - LIME/CEMENT/FLYASH + PLASTIC FIBERS

3.1 PURPOSE

The purpose of these tests is to analyze the effect of adding plastic fibers to the previously established mixtures of lime/cement/flyash. The same 2 by 2 factorial experiment utilized for lime/cement/flyash was incorporated for these mixtures. The plastic fibers should act as a reinforcing additive to help the mixtures during durability testing.

3.2 PROCEDURE

Initially, a sludge mixture was made using 5 parts pond water, 1 part crystal and 1 part underlying sludge (by volume). This ratio of the "sludge mixture" was held constant for all 5 batches. The batches that were mixed are defined in Table 3-1, with Batch #5 being the previously defined center point.

Hydrated lime was used to achieve an initial pH of 11.5 to 12 for the sludge mixture. Following the pH adjustment, Type V cement, Type C "comanche" flyash and plastic fibers were added. The mixture was wet mixed for 5 min.

Plastic fibers were added at approximately 0.025% of the total weight of the pozzolanic material in the mixture as specified by vendors literature.

Eight cylinders were made for each batch. After curing, products were tested for UCS using ASTM Methhod C39-86. TCLP extraction and metals analyses were also conducted on the accelerated cure cylinders. The freeze/thaw and wet/dry durability test procedures were modified to enable the testing to be completed prior to the start of the final phase. The control cyclinder (i.e., volume and moisture loss specimen) was omitted, thus only one cylinder was submitted for each test. The dimension measurements and the weighing of the cylinders was done as specified in the methods. The freeze/thaw procedure was accelerated by reducing the time of freezing from 24 hours/cycle to 12 hours/cycle. The wet/dry procedure was accelerated by decreasing the drying period from 42 hours to 19 hours and the time of submergence from 5 hours to 4 hours. Table 3-2 defines curing times and the cylinders required for each test.

ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

FREEZE/THAW TEST
~~In cycle. #Completed~~ 5 cycles completed

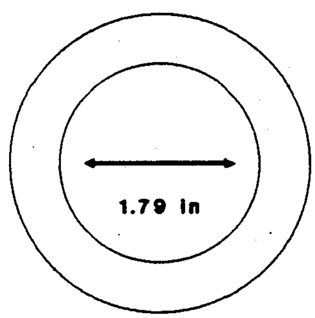
CYLINDER NAME:
M2 2.3S

207C w/ SILICATE

Mixed 1/17/92

OBSERVATIONS:
Dia: 1.98 in.
Height: 3.99 in.

Minimum flaking
Minimum grooves
Cracking on diameter and longitude



M2 2.3S

ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

FREEZE/THAW TEST
~~In cycle. #Completed~~ 5 cycles completed

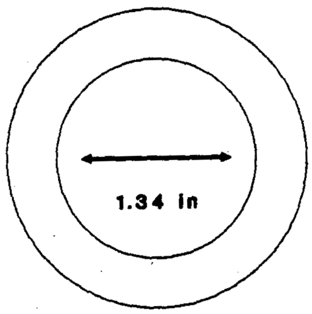
CYLINDER NAME:
M3 3.3S

207C w/ SILICATE

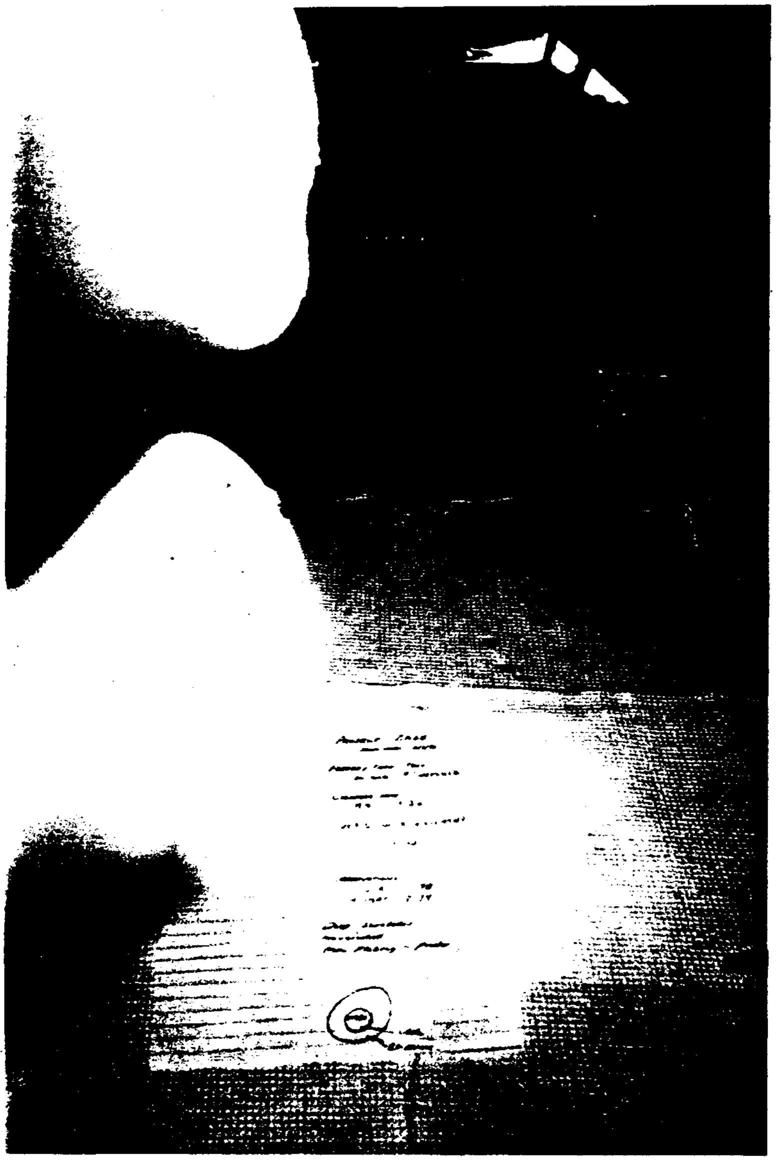
Mixed 1/17/92

OBSERVATIONS:
Dia: 1.94 in.
Height: 3.68 in.

Deep scratches
Minimum flaking, but powdering
Very bad cylinder
Donut



M3 3.3S



ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

FREEZE/THAW TEST
~~In cycle: #Completed~~ 5 cycles completed.

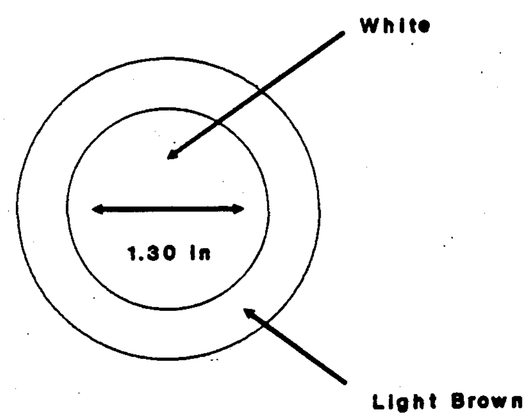
CYLINDER NAME:
M4 4.3S

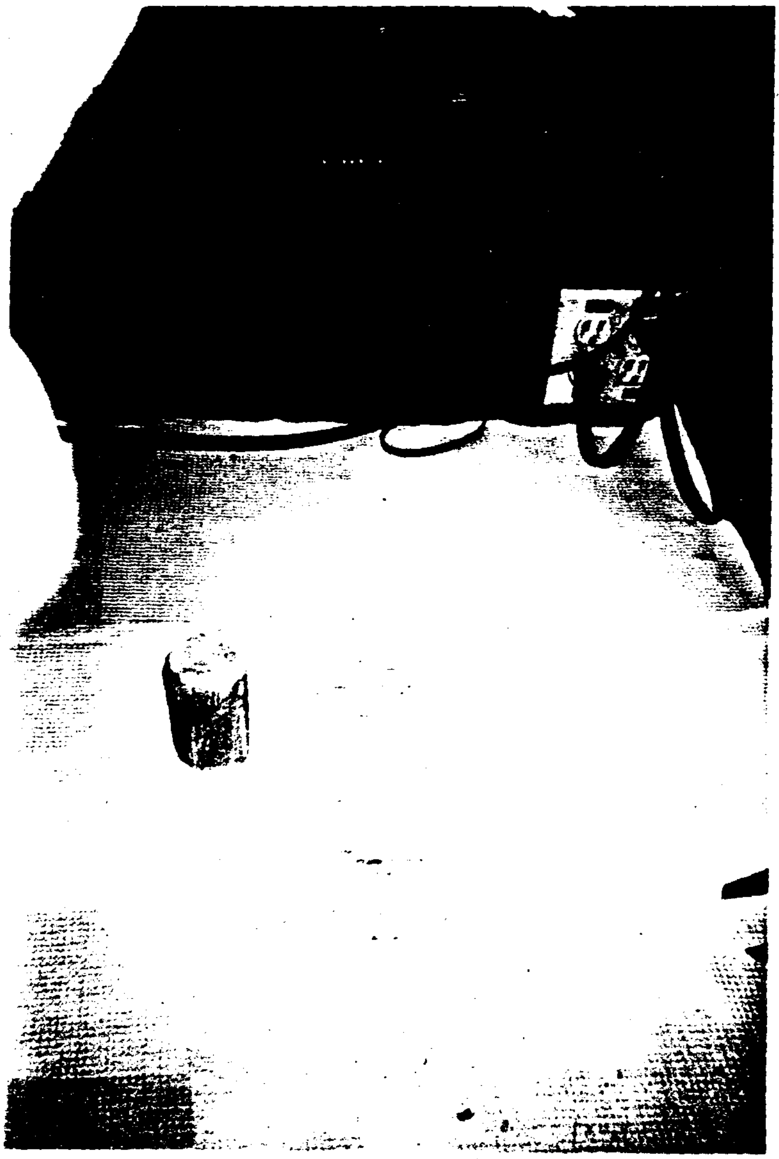
207C w/ SILICATE

Mixed 1/17/92

OBSERVATIONS:
Dia: 1.98 in.
Height: 3.74 in.

Deep scratches
Non-cracked
Minimum flaking/powder





ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

FREEZE/THAW TEST
~~In cycle: #Completed~~ 5 cycles completed

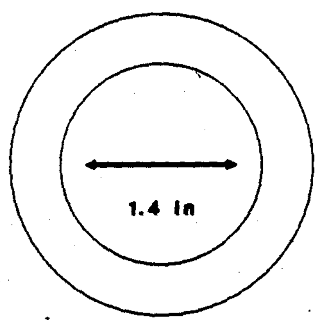
CYLINDER NAME:
M5 5.3S

207C w/ SILICATE

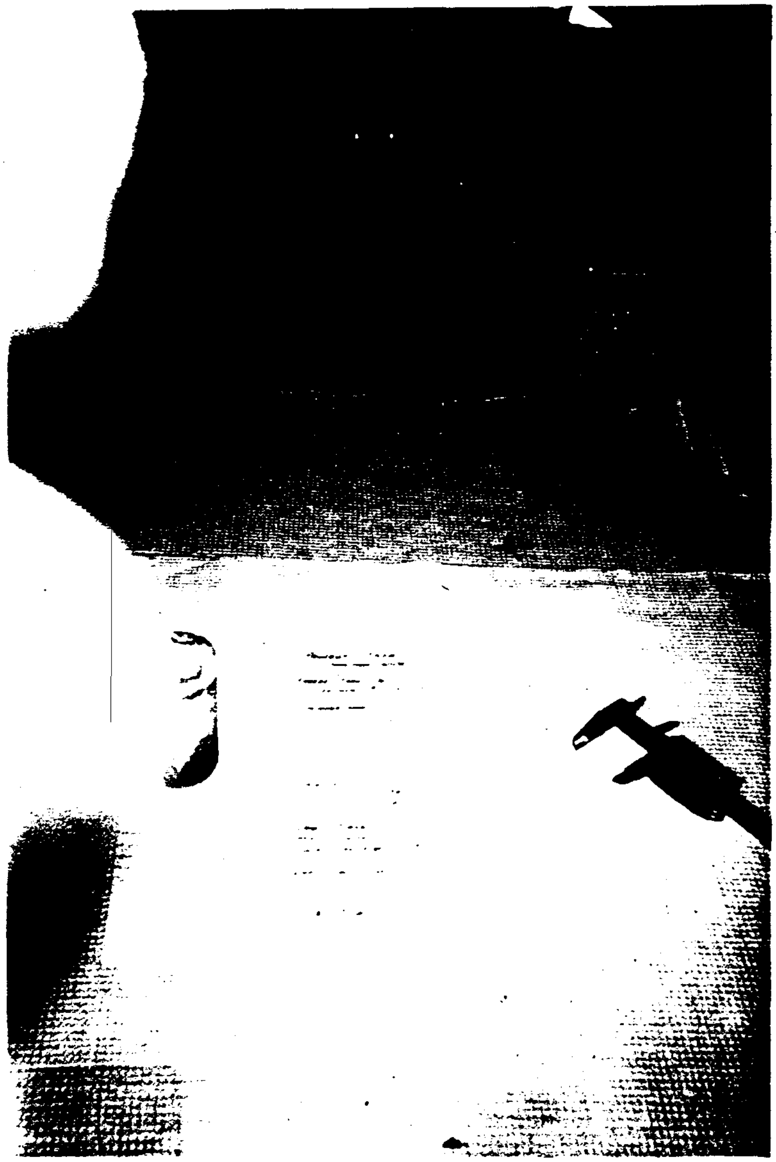
Mixed 1/17/92

OBSERVATIONS:
Dia: 1.98 in.
Height: 3.87 in.

Deep scratches
Minimum flaking
Minimum cracking
Poor cylinder
Donut



M5 5.3S



ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

FREEZE/THAW TEST
~~In cycle: #Completed~~ 5 cycles completed

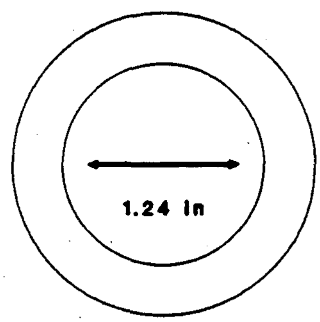
CYLINDER NAME:
M6 6.3S

207C w/ SILICATE

Mixed 1/17/92

OBSERVATIONS:
Dia: 1.98 in.
Height: 3.81 in.

Deep scratches
Minimum flaking
Cracks like elephant skin
Donut color change



M6 6.3S

ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

FREEZE/THAW TEST
~~In cycle: #Completed~~ 5 cycles completed

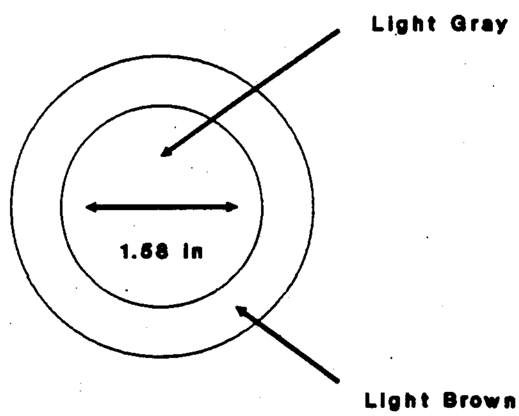
CYLINDER NAME:
M7 7.4S

207C w/ SILICATE

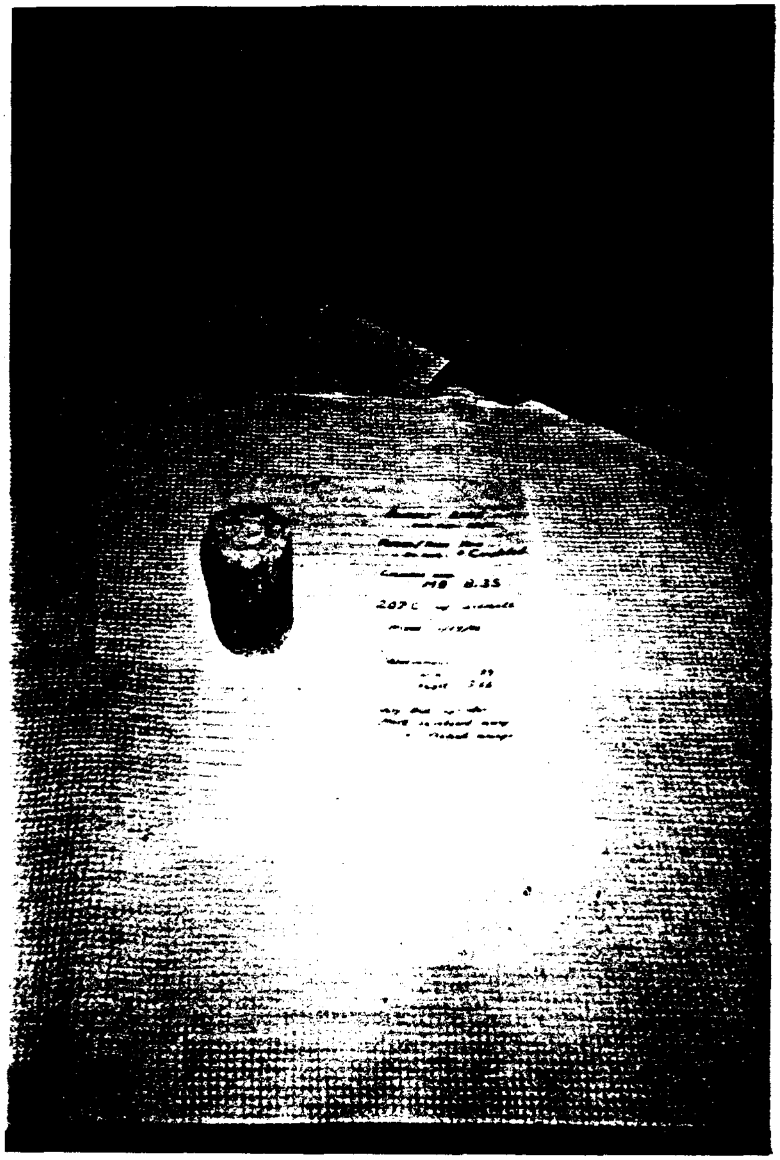
Mixed 1/17/92

OBSERVATIONS:
Dia: 1.98 in.
Height: 3.88 in.

A lot of flaking and cracks
Deep scratches
Donut



M7 7.4S



ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

FREEZE/THAW TEST
~~In cycle. #Completed~~ 5 cycles completed

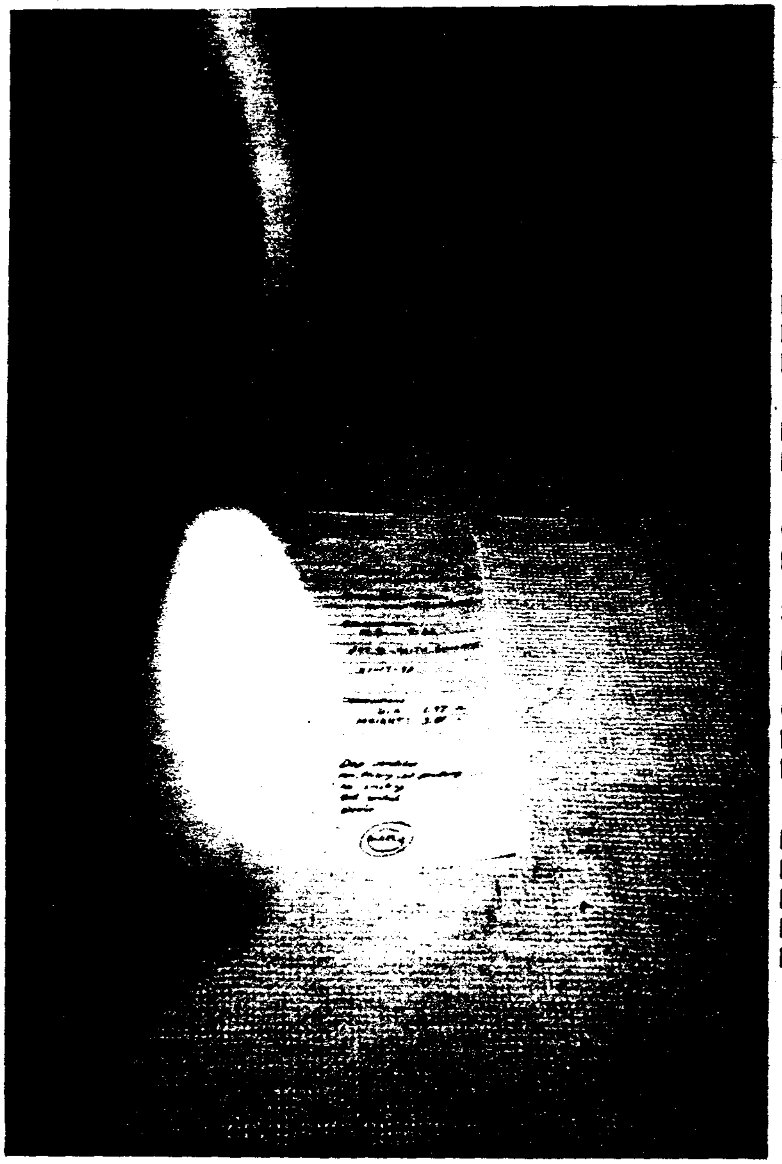
CYLINDER NAME:
M8 8.3S

207C w/ SILICATE

Mixed 1/17/92

OBSERVATIONS:
Dia: 1.89 in.
Height: 3.66 in.

Very bad cylinder
Most scratched away
or flaked away



ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

FREEZE/THAW TEST
~~In cycle: #Completed~~ 5 cycles completed

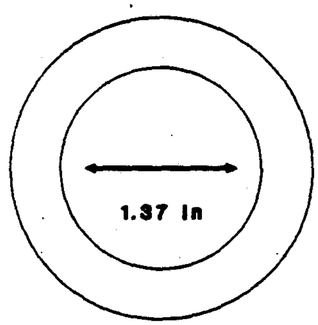
CYLINDER NAME:
M9 9.3S

207C w/ SILICATE

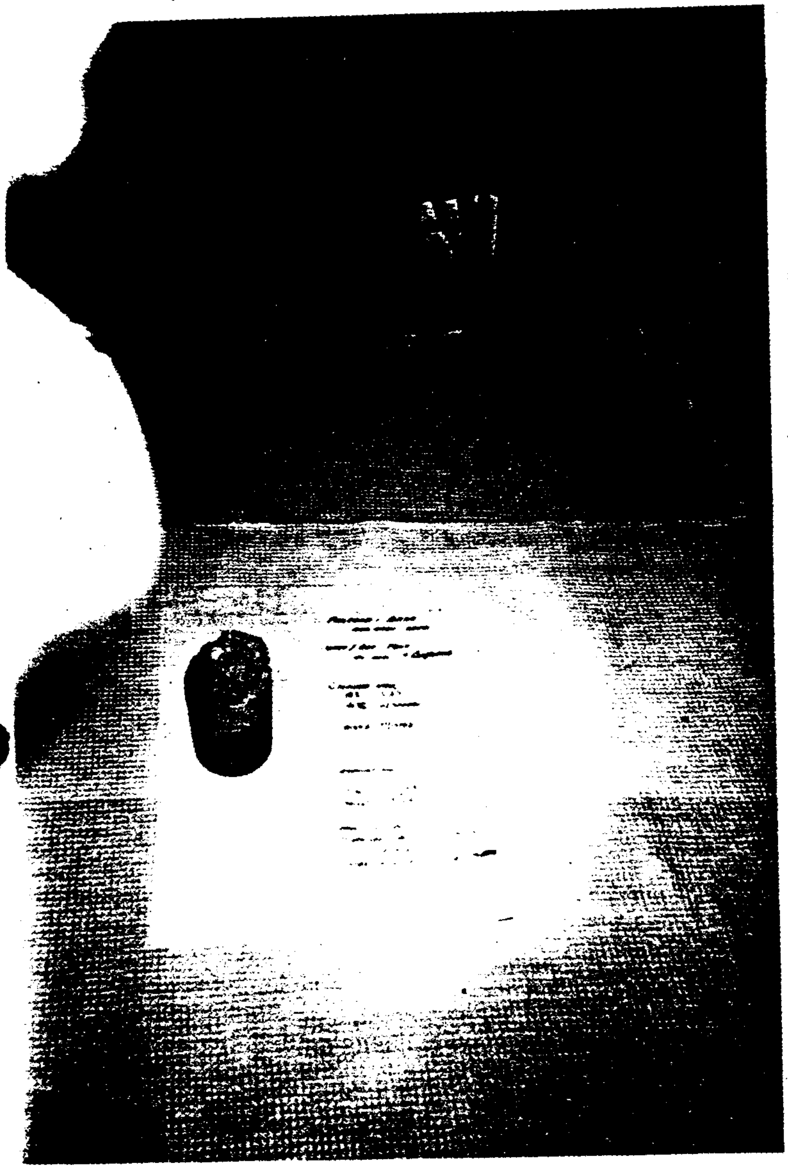
Mixed 1/17/92

OBSERVATIONS:
Dia: 1.97 in.
Height: 3.81 in.

Deep scratches
Minimum flaking, but powdering
No cracking
End eroded
Donut



M9 9.3S



ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

WET/DRY TEST
~~In cycle. #Completed~~ 5 cycles completed

CYLINDER NAME:
M3 3.2S

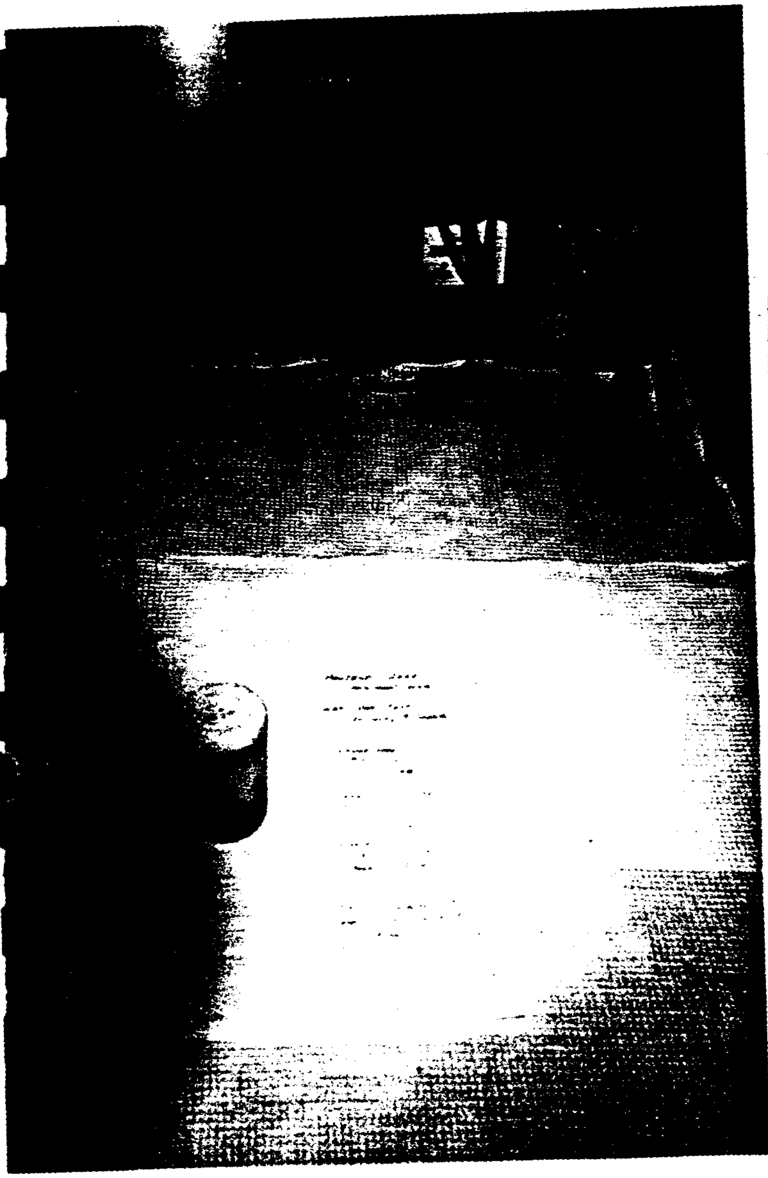
207C w/ SILICATE

Mixed 1/17/92

OBSERVATIONS:
Dia: 1.99 in.
Height: 3.68 in.

Bad cylinder
Moderate hairline cracks
and scratching
Large amount of end flaking

M3 3.2S



ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

WET/DRY TEST
In cycle: #Completed

CYLINDER NAME:
M4 4.2S

w/ SILICATE – 207C

Mixed 1/17/92

OBSERVATIONS:
Dia: 1.99 in.
Height: 3.81 in.

Moderate elephant skin
Deep scratch with end flaking

M4 4.2S

ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

WET/DRY TEST
~~In cycle: #Completed~~ 5 cycles completed

CYLINDER NAME:
M5 5.2S

207C w/ SILICATE

Mixed 1/17/92

OBSERVATIONS:
Dia: 1.99 in.
Height: 3.90 in.

Moderate scratching and hairline cracks

M5 5.2S

ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

WET/DRY TEST
~~In cycle: #Completed~~ 5 cycles completed

CYLINDER NAME:
M6 6.2S

w/ SILICATE—207C

Mixed 1/17/92

OBSERVATIONS:
Dia: 1.99 in.
Height: 3.91 in.

Moderate scratching
Corner or end flaking
Top showed water separation

M6 6.2S

ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

WET/DRY TEST
~~In cycle: #Completed~~ 5 cycles completed

CYLINDER NAME:
M7 7.2S

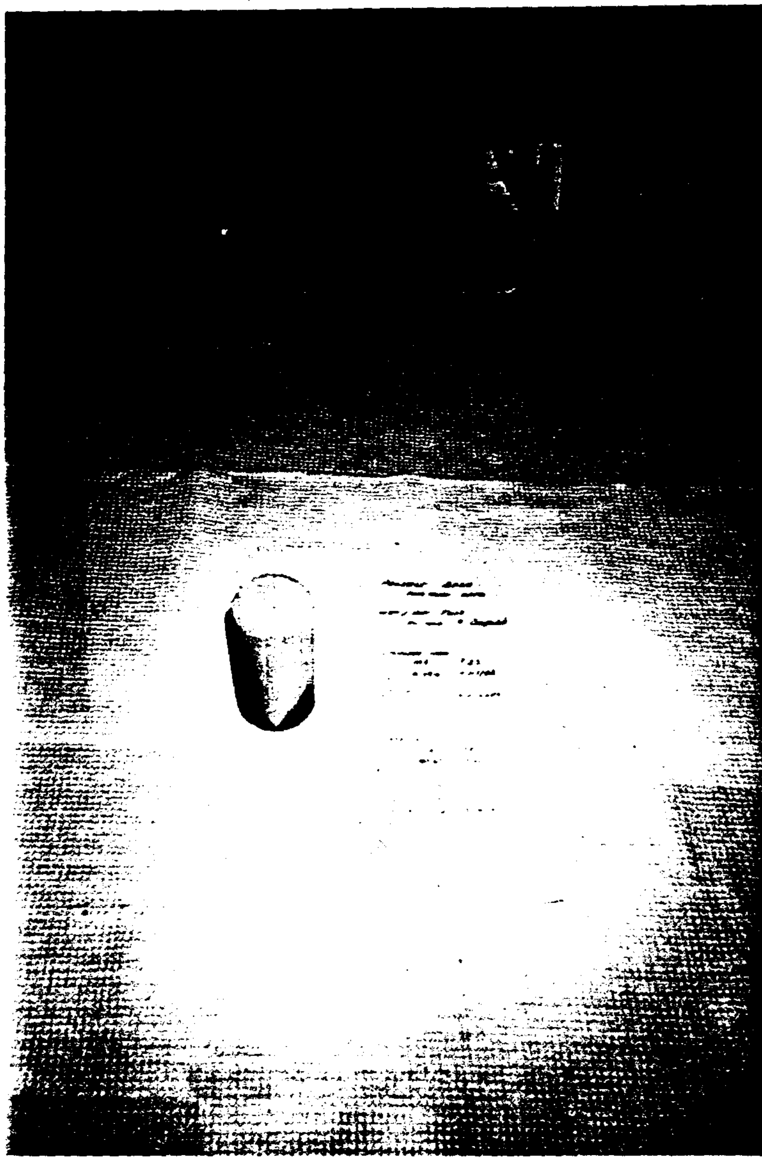
w/ SILICATE-207C

Mixed 1/17/92

OBSERVATIONS:
Dia: 1.98 in.
Height: 3.95 in.

Moderate scratching
and hairline cracking
and end flaking

M7 7.2S



ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

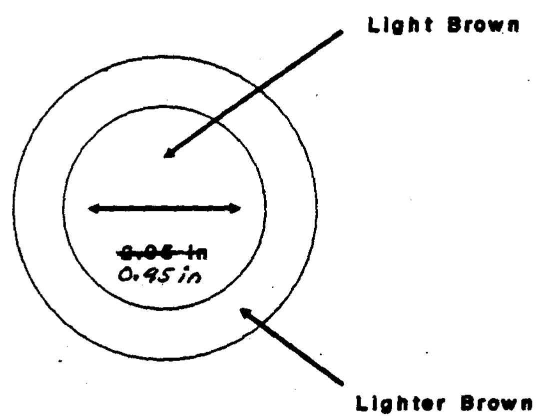
WET/DRY TEST
~~In cycle: #Completed~~ 5 cycles completed

CYLINDER NAME:
M9 9.2S
Mixed 1/17/92

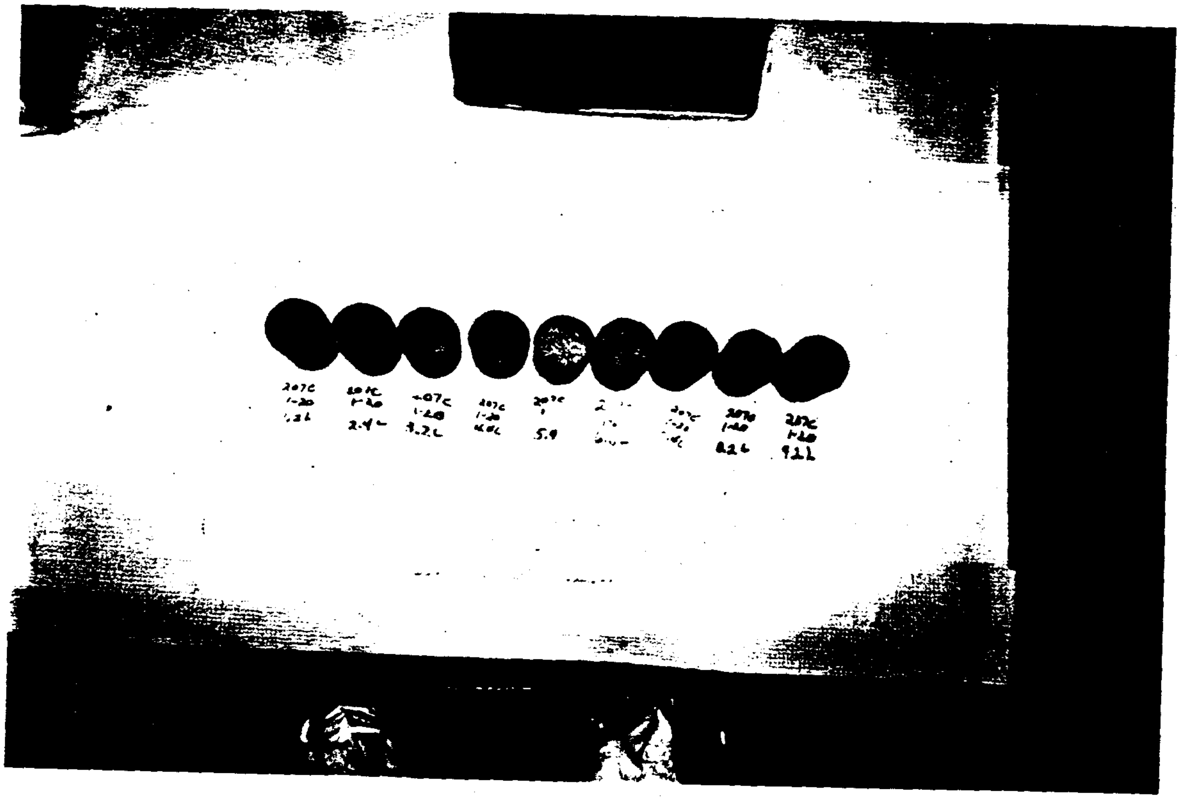
207C w/ SILICATE

OBSERVATIONS:
Dia: 1.98 in.
Height: 3.82 in.

Moderate hairline cracks
Deep scratches
Moderate end flaking

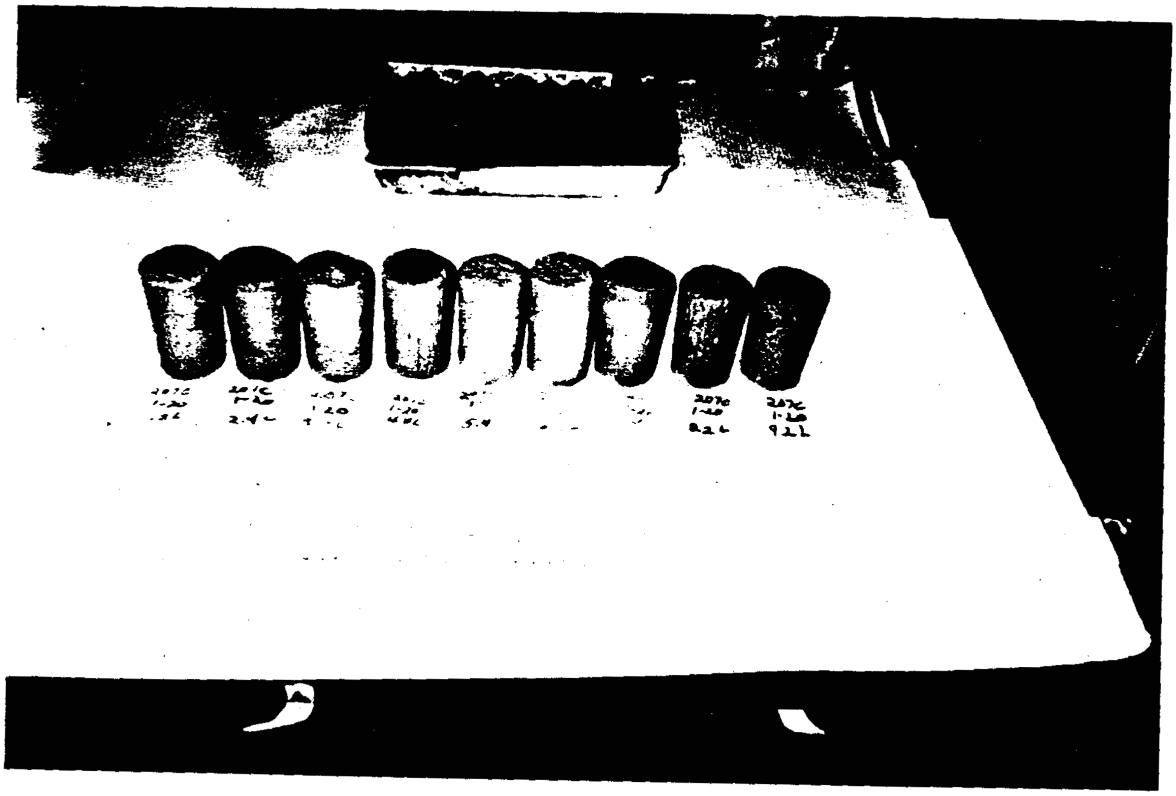


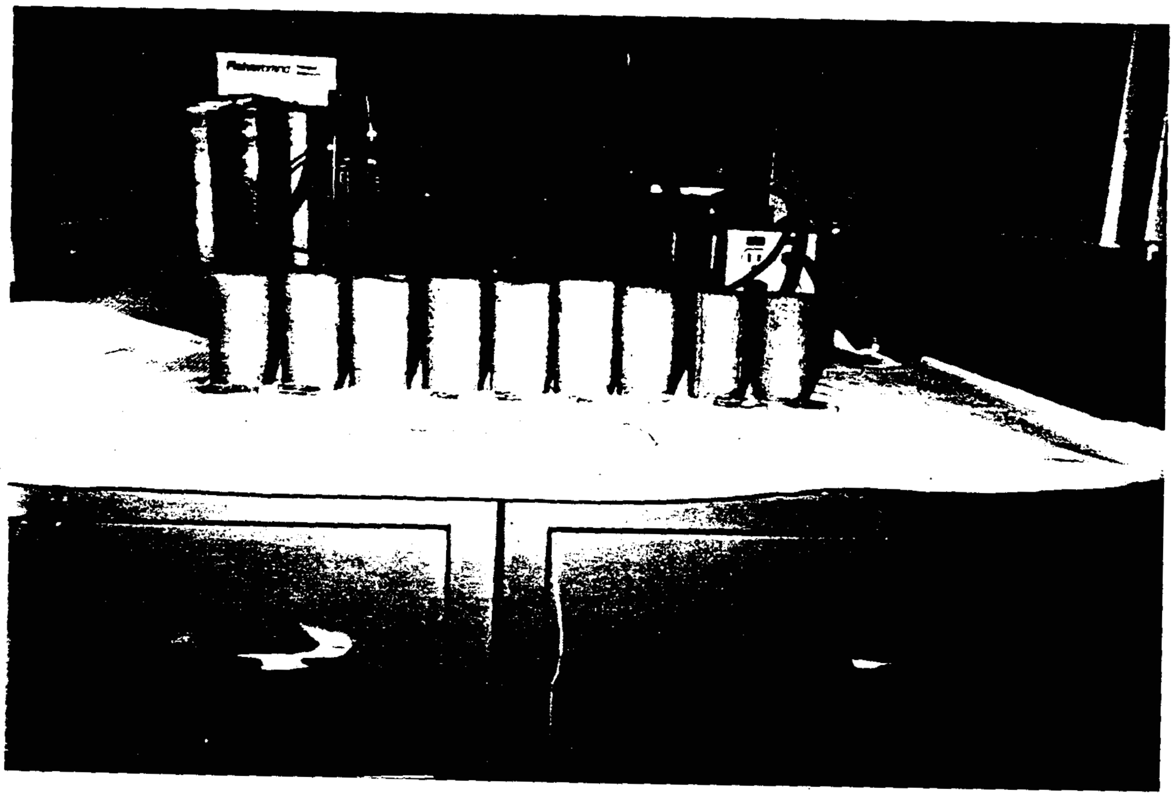
207C WITH LIME/CEMENT/FLYASH + LATEX
FREEZE/THAW CYCLE 10



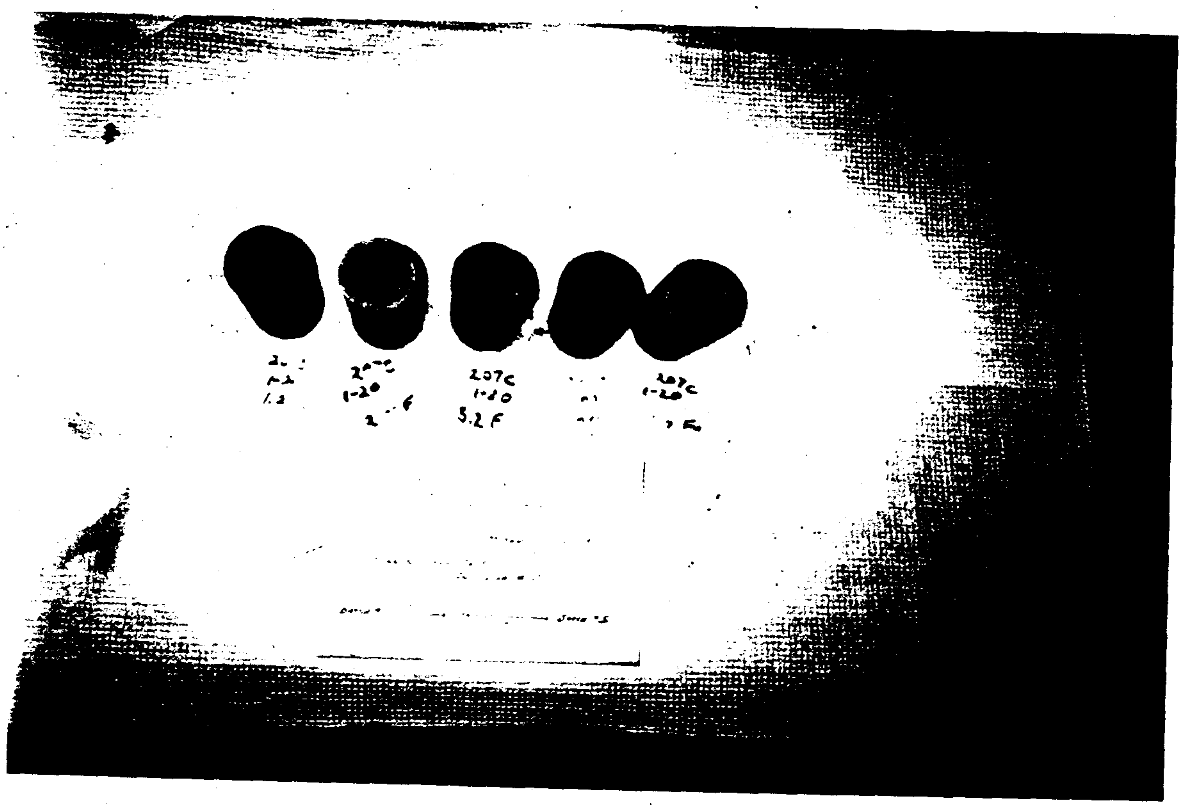
207C WITH LIME/CEMENT/FLYASH + LATEX
WET/DRY CYCLE 10

207C WITH LIME/CEMENT/FLYASH + LATEX
FREEZE/THAW CYCLE 10

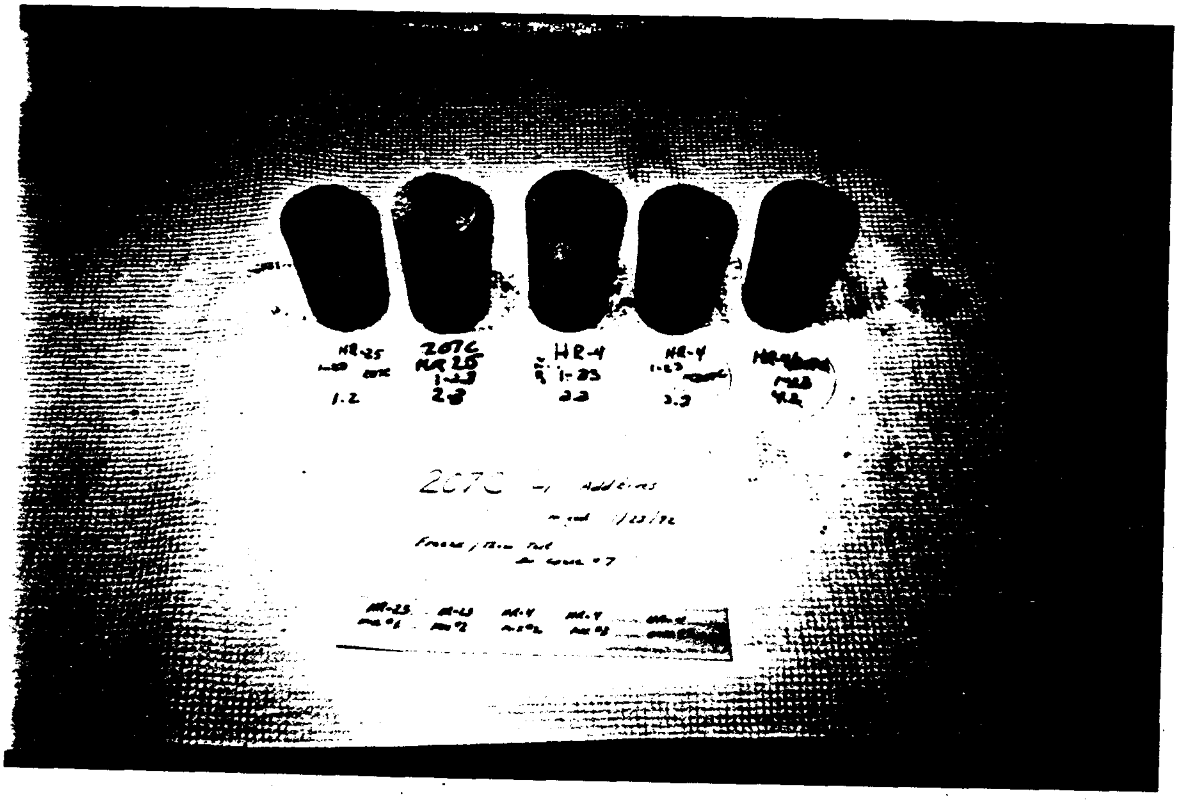


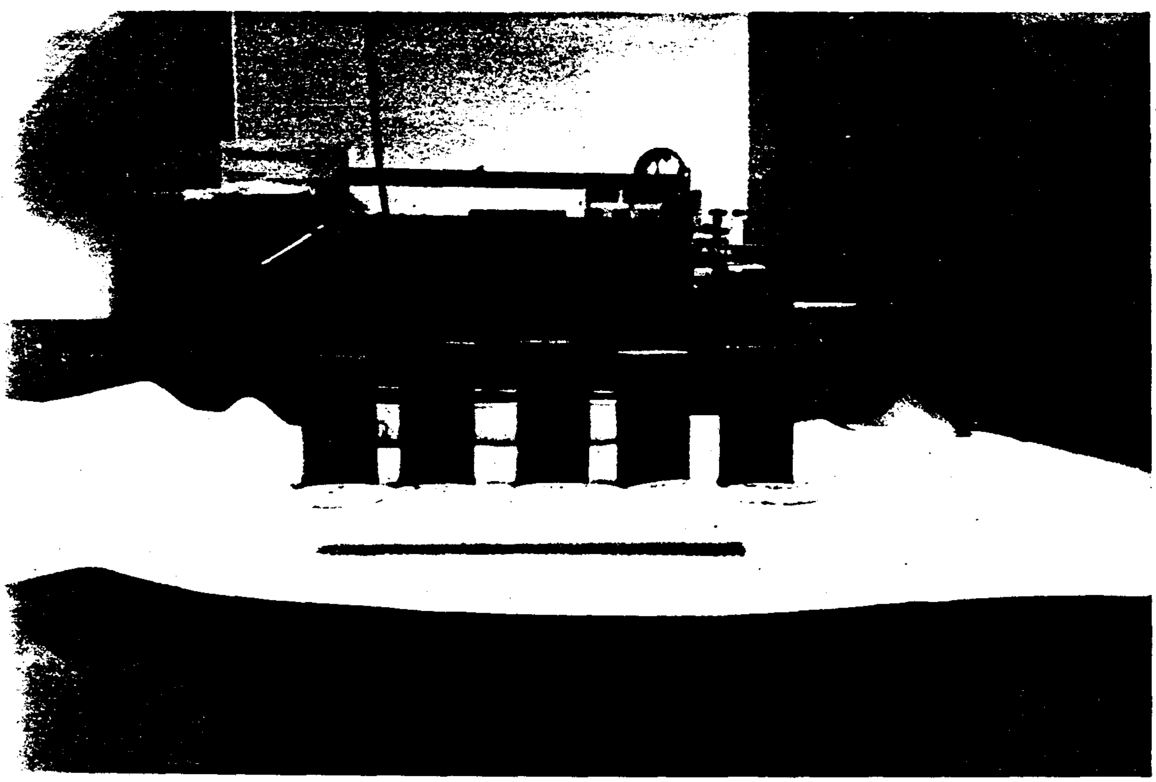


207C WITH LIME/CEMENT/FLYASH + PLASTIC FIBER
FREEZE/THAW CYCLE 10

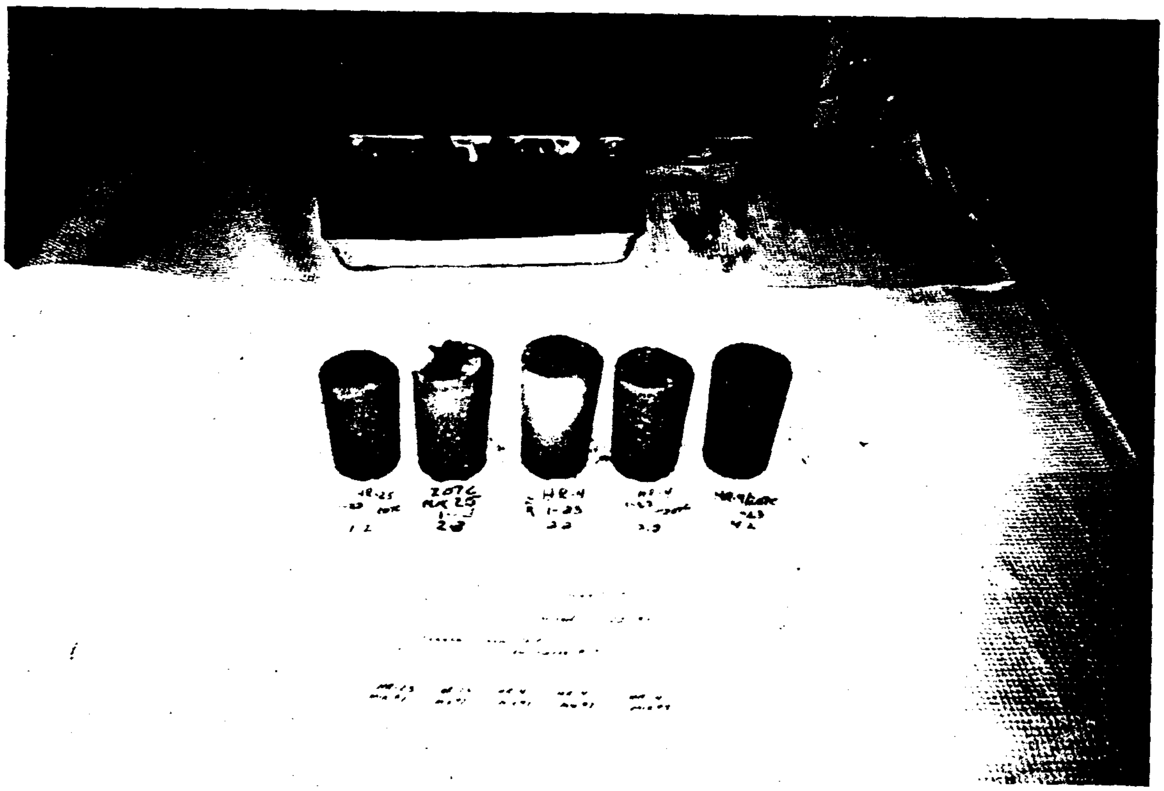


207C WITH LIME/CEMENT/FLYASH + HR4 AND HR25
FREEZE/THAW CYCLE 7





207C WITH LIME/CEMENT/FLYASH + HR4 AND HR25
FREEZE/THAW CYCLE 7



207C WITH LIME/CEMENT/FLYASH + PLASTIC FIBERS
WET/DRY CYCLE 10

207C WITH LIME/CEMENT/FLYASH + HR4 AND HR25
WET/DRY CYLCE 7

APPENDIX C

FLYASH SPEC SHEETS

REPORT OF FLY ASH ANALYSIS

RESOURCE MATERIALS TESTING, INC.

"Specialists in Fly Ash Testing"

REPORT TO: Western Ash Company
4380 S. Syracuse Street
Suite 305
Denver, CO 80237
Attn: Mr. Harry Roof

PROJECT NO.: RMT-021
SAMPLE NO.: 2381
DATE REC.: 4-5-90
DATE REP.: 5-8-90

PROJECT NAME: Pawnee Plant Fly Ash Q.A. Program

SAMPLE ID: Class C Fly Ash QAP #137 March '91

PARAMETER	RESULTS	ASTM C618 SPEC. F/C
CHEMICAL ANALYSES		
Silicon Dioxide, SiO_2, %	34.1	---
Aluminum Oxide, Al_2O_3, %	20.5	---
Iron Oxide, Fe_2O_3, %	7.2	---
Sum of SiO_2, Al_2O_3, Fe_2O_3, %	61.8	70/50 min
Calcium Oxide, CaO, %	26.1	---
Magnesium Oxide, MgO, %	6.1	---
Sodium Oxide, Na_2O, %	---	---
Potassium Oxide, K_2O, %	---	---
Sulfur Trioxide, SO_3, %	2.7	5.0 max
Moisture Content, %	0.02	3.0 max
Loss on Ignition, %	0.27	6.0 max
Available Alkalies as Na_2O, %*	1.20	1.5 max
PHYSICAL ANALYSES		
Amount Retained on No. 325 Sieve, %	14.1	34 max
Pozzolanic Activity Index		
Portland Cement at 7 days, % of Control	105	75 min
Portland Cement at 28 days, % of Control	109	75 min
Lime at 7 days, psi	---	800/NA min
Water Requirement, % of Control	91	105 max
Autoclave Expansion, %	+0.05	0.8 max
Specific Gravity	2.74	---
Increase of Drying Shrinkage, %*	---	0.03 max
Reactivity with Cement Alkalies, %*		
Reduction of Mortar Expansion, %	---	---
Mortar Expansion, %	---	0.020 max

*Optional requirements applicable only when requested by the purchaser.

By Robert L. Smith
Robert L. Smith, Ph.D.

532 Myrtle Street, S.W. • Gainesville, Georgia 30501 • (404) 287-7907 • FAX (404) 287-7920

REPORT OF FLY ASH ANALYSIS

RESOURCE MATERIALS TESTING, INC.

"Specialists in Fly Ash Testing"

REPORT TO: Western Ash Company
4380 S. Syracuse Street
Suite 305
Denver, CO 80237
Attn: Mr. Harry Roof

PROJECT NO.: RMT-018
SAMPLE NO.: 2379
DATE REC.: 4-5-90
DATE REP.: 5-8-90

Comanche #1
PROJECT NAME: Comanche Plant Fly Ash Q.A. Program

SAMPLE ID: Class C Fly Ash QAP #119 March '91

CHEMICAL ANALYSES PARAMETER	RESULTS	ASTM C618 SPEC. F/C
Silicon Dioxide, SiO_2, %	29.5	---
Aluminum Oxide, Al_2O_3, %	22.8	---
Iron Oxide, Fe_2O_3, %	5.1	---
Sum of SiO_2, Al_2O_3, Fe_2O_3, %	57.4	70/50 min
Calcium Oxide, CaO, %	28.9	---
Magnesium Oxide, MgO, %	5.1	---
Sodium Oxide, Na_2O, %	---	---
Potassium Oxide, K_2O, %	---	---
Sulfur Trioxide, SO_3, %	3.7	5.0 max
Moisture Content, %	0.01	3.0 max
Loss on Ignition, %	1.13	6.0 max
Available Alkalies as Na_2O, %*	3.52	1.5 max
PHYSICAL ANALYSES		
Amount Retained on No. 325 Sieve, %	13.7	34 max
Pozzolanic Activity Index		
Portland Cement at 7 days, % of Control	92	75 min
Portland Cement at 28 days, % of Control	94	75 min
Lime at 7 days, psi	---	800/NA min
Water Requirement, % of Control	93	105 max
Autoclave Expansion, %	+0.05	0.8 max
Specific Gravity	2.66	---
Increase of Drying Shrinkage, %*	---	0.03 max
Reactivity with Cement Alkalies, %*		
Reduction of Mortar Expansion, %	---	---
Mortar Expansion, %	---	0.020 max

*Optional requirements applicable only when requested by the purchaser.

By Robert L. Smith
Robert L. Smith, Ph.D.

532 Myrtle Street, S.W. • Gainesville, Georgia 30501 • (404) 287-7907 • FAX (404) 287-7920

WAL

WAL, Inc.

6385 W 52nd Ave., #5 (303) 420-7700 Arvada, CO 80002

June 6, 1991

Mr. Matt Lahrs
Western Ash Company
4380 S. Syracuse St. Suite 305
Englewood, CO 80155

WAL # 91177-1
Sample ID: COMMANCHE #2

CHEMICAL ANALYSIS
WT%, DRY BASIS

Silicon Dioxide, SiO2	34.86	
Aluminum Oxide, Al2O3	17.96	
Iron Oxide, Fe2O3	5.75	
Total (SiO2 + Al2O3 + Fe2O3)		58.57
Calcium Oxide, CaO	27.93	
Magnesium Oxide, MgO	4.60	
Sodium Oxide, Na2O	1.55	
Potassium Oxide, K2O	0.22	
Titanium Dioxide, TiO2	1.58	
Manganese Dioxide, MnO2	0.16	
Phosphorus Pentoxide, P2O5	1.22	
Strontium Oxide, SrO	0.51	
Barium Oxide, BaO	0.60	
Sulfur Trioxide, SO3	2.59	
Loss on Ignition	0.50	
Moisture, as Received	0.13	

Laboratory Manager

CLIENT DUPLICATE

HALLIBURTON NUS
Environmental Laboratories

5350 Campbells Run Road
Pittsburgh, PA 15205
800-228-6870

6751-L Engle Roa
Cleveland, OH 44
216-891-4700

September 26, 199
Report No.: 0000281
Section A Page 1

LABORATORY ANALYSIS REPORT

CLIENT NAME: HALLIBURTON NUS ENVIRONMENTAL
ADDRESS: 5950 N. COURSE DR/P.O BOX 721110
HOUSTON, TX 77272-
ATTENTION: MR. DON BRENNEMAN

NUS CLIENT NO: 0165 00
WORK ORDER NO: 2K65
VENDOR NO:

Carbon Copy:

SAMPLE ID: WESTERN ASH / COMANCHE FLYASH #1
NUS SAMPLE NO: P0155726
P.O. NO.:

DATE SAMPLED: UnAvail
DATE RECEIVED: 17-JUN-9
APPROVED BY: J Siman

LN	TEST CODE	DETERMINATION	RESULT	UN
1	R035	Gross Alpha and Beta Screen		
		Gross Alpha Screen	33 +/- 10	pCi/g
		Gross Beta Screen	25 +/- 8	pCi/g
2	115	Available Calcium Oxide	4.9	%

COMMENTS:

HALLIBURTON NUS
Environmental Laboratories

5350 Campbells Run Road
Pittsburgh, PA 15205
800-228-6870

6751-L Engle Road
Cleveland, OH 44130
216-891-4700

September 26, 1991
Report No.: 00002913
Section A Page 2

LABORATORY ANALYSIS REPORT

CLIENT NAME: HALLIBURTON NUS ENVIRONMENTAL
ADDRESS: 5950 N. COURSE DR/P.O BOX 721110
HOUSTON, TX 77272-
ATTENTION: MR. DON BRENNEMAN

NUS CLIENT NO: 0165 0075
WORK ORDER NO: 2K68
VENDOR NO:

Carbon Copy:

SAMPLE ID: WESTERN ASH / COMANCHE FLYASH #2
NUS SAMPLE NO: P0165727
P.O. NO.:

DATE SAMPLED: UnAvail
DATE RECEIVED: 17-JUN-91
APPROVED BY: J Simanic

LN	TEST CODE	DETERMINATION	RESULT	UNITS
1	R03S	Gross Alpha and Beta Screen		
		Gross Alpha Screen	42 +/- 10	pCi/g
		Gross Beta Screen	29 +/- 8	pCi/g
2	T15	Available Calcium Oxide	4.0	%

COMMENTS:

CLIENT DUPLICATE

HALLIBURTON NUS
Environmental Laboratories

5350 Campbells Run Road
Pittsburgh, PA 15205
800-228-6870

6751-L Engle Road
Cleveland, OH 44130
216-891-4700

September 25, 1991
Report No.: 00002761
Section A Page 1

LABORATORY ANALYSIS REPORT

CLIENT NAME: HALLIBURTON NUS ENVIRONMENTAL
ADDRESS: 5950 N. COURSE DR/P.O BOX 721110
HOUSTON, TX 77272-
ATTENTION: MR. DON BRENNEMAN

NUS CLIENT NO: 0165 0075
WORK ORDER NO: 2K68
VENDOR NO:

Carbon Copy:

SAMPLE ID: WESTERN ASH CO. - PAWNEE FLYASH
NUS SAMPLE NO: P0165656
P.O. NO.:

DATE SAMPLED: UnAvail
DATE RECEIVED: 14-JUN-91
APPROVED BY: J Simanic

LN	TEST CODE	DETERMINATION	RESULT	UNIT
1	R03S	Gross Alpha and Beta Screen		
		Gross Alpha Screen	31 +/- 9	pCi/g
		Gross Beta Screen	19 +/- 7	pCi/g
2	T15	Available Calcium Oxide	4.6	%

COMMENTS:

ATTACHMENT A-3

TECHNICAL MEMORANDUM
CLARIFIER STABILIZATION RESULTS
FROM INITIAL PHASE OF TESTING

TECHNICAL MEMORANDUM

CLARIFIER
STABILIZATION RESULTS
FROM PHASES OF TESTING

Prepared by:

HALLIBURTON NUS ENVIRONMENTAL CORPORATION

REVISION 0

JUNE 1992

1.0 INTRODUCTION

The purpose of this report is to summarize the results of the clarifier treatability studies completed to date. Since completion of this testing, a decision has been made to process the clarifier with 207C as opposed to by itself. Therefore, the data in this report will only be used for input in developing the formula for the 207C slurry combined with the clarifier contents.

Testing for the clarifier began in January and consisted of preparing solidification formulations with lime/cement/flyash. The testing also evaluated plastic fibers and sodium silicate to improve the stabilized product. The testing for the solidified product included unconfined compressive strength (UCS), TCLP extraction, and wet/dry, freeze/thaw durability testing.

Testing discussed in this report is based primarily on 48-hour accelerated curing and accelerated durability testing. Cylinders were cured for 12 days prior to initiation of the durability testing. The solidification formulas used Type V cement because of the sulfate concentration in the clarifier. The flyash used was Type C .

This report will consist of six sections. Section 1.0 consists of this brief introduction. Section 2.0 describes the testing conducted for the baseline formulation with lime/cement/flyash. Section 3.0 describes the testing to evaluate plastic fibers and Section 4.0 describes the testing to evaluate sodium silicate. Section 5.0 describes the initial durability testing. Section 6.0 provides conclusions and recommendations based on the data provided in the report.

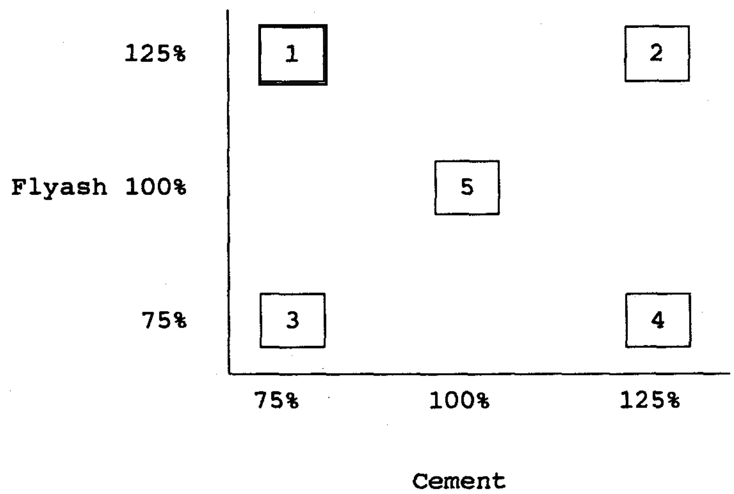
2.0 STABILIZATION OF THE CLARIFIER WITH LIME/CEMENT/FLYASH FORMULATION

2.1 PURPOSE

The purpose of these tests was to define baseline ratios of cement (Type V) and flyash (Type C) utilizing factorial experimentation (2x2) around a previously defined center point. This experiment is conceptually illustrated in Figure 2-1. The goal of this testing was to provide a baseline ratio of cement and flyash to which additives could be incorporated if needed.

FIGURE 2-1

FACTORIAL EXPERIMENT OF CEMENT/FLYASH RATIOS



2.2 PROCEDURE

Initially, a sludge mixture was made using 5 parts clarifier sludge and 1 part clarifier water (by volume). This ratio of the "sludge mixture" was held constant for all 5 batches. The percent solids of the "sludge mixture" was approximately 25.3%. The batches that were mixed are defined in Table 2-1 with Batch #5 being the center point.

Hydrated lime (35 grams) was used to achieve a pH of 11.5 to 12 for the sludge mixture. Following the pH adjustment, the Type V cement and Type C "comanche" flyash were added. The mixture was wet mixed for 5 minutes in a HOBART mixer.

Six cylinders were made for each batch. After curing, products were tested for UCS using ASTM Method C39-86. TCLP extraction and metals analysis were also conducted. The freeze/thaw and wet/dry durability test procedures were modified

2.3 RESULTS

This section will provide the results for the TCLP analysis, UCS, and the durability testing.

The TCLP results are provided in Table 2-3. The results in Table 2-3 indicated that all of the metal analysis results are below their LDR and Toxicity Characteristic Levels. The pH of the TCLP extraction ranged between 9.3 and 9.5.

The UCS results are provided in Table 2-4. The UCS results indicate that all of the cylinders became hard with the strengths ranging from approximately 200 psi to greater than 637 psi. The strength that each cylinder achieved correlated with the quantity of cement added.

The durability testing is summarized in Table 2-5. Review of this table indicates that Batches 1, 2, and 3 passed the freeze/thaw testing with little or no loss in UCS. Batches 4 and 5 failed the freeze/thaw testing in cycle 8 and 12 respectively. In general, there does not appear to be an obvious reason why cylinders from Batch 4 and 5 failed considering that cylinders with less cement and total pozzolans passed the testing.

All of the cylinders failed in the wet/dry testing very early in the testing. The reason for this failure may be related to the sulfate present in the clarifier sludge having adverse reactions with components in the Type C flyash. At the elevated temperatures (70°C) which the test is conducted, during the drying cycle, the sulfate reacts with components of the flyash to form an unstable product and subsequent failure of the test. Additionally, the high water to pozzolan ratio (ratio varied from .69 to .99) may have contributed to the cylinders failing the wet/dry tests.

TABLE 2-1

BATCHES FOR CLARIFIER SOLIDIFICATION

	Sludge Mixture	Cement	Flyash	Lime
Batch 1	2000g	536.0g	1625.0g	35g
Batch 2	2000g	837.5g	35g	1625.0g
Batch 3	2000g	536.0g	975.0g	35g
Batch 4	2000g	837.5g	975.0g	35g
Batch 5	2000g	670.0g	1300.0g	35g

TABLE 2-2

SUMMARY OF TESTING SCHEDULE
CLARIFIER - LIME/CEMENT/FLYASH

Curing Time	UCS	TCLP (Metals)	Freeze/Thaw + UCS	Wet/Dry + UCS
48 hrs	1	1	NA	NA
7-day	2	NA	NA	NA
12-day	NA	NA	1	1

NA - Not Analyzed

to enable the testing to be completed in a expedient manner because of schedule constraints. The control cylinder (i.e. volume and moisture control specimen) was omitted, thus only one cylinder was submitted for each test. The dimension measurements and the weighing of the cylinders were omitted. Brushing of the cylinders was done as specified in the methods. The freeze/thaw procedure was accelerated by reducing the time of freezing from 24 hours/cycle to 12 hours/cycle. The wet/dry procedure was accelerated by decreasing the drying period from 42 hours to 19 hours and the time of submergence from 5 hours to 4 hours. Table 2-2 defines curing times and the cylinders required for each test.

Originally, no testing was scheduled for durability testing because of constraints imposed by the schedule for these batches. Limited durability testing was only to be conducted using a cylinder from the center points of the testing as described in Section 5.0. However, these cylinders failed the durability testing very early which raised concerns. Based on the failures of the center point cylinder it was decided to submit cylinders from all of the batches for accelerated durability testing. These cylinders were submitted after 12 days of curing.

TABLE 2-3

AFTER 48-HR ACCELERATED CURE TCLP RESULTS (mg/L)
CLARIFIER SLUDGE - LIME/CEMENT/FLYASH

ANALYTE	BATCH #1	BATCH #2	BATCH #3	BATCH #4	BATCH #5	TOXICITY CHARACTERISTIC STANDARD	NONWASTEWATER LDR STANDARD
Arsenic, Leachable (As)	0.0740	0.107	0.112	0.112	<0.06	5.0	---
Barium, Leachable (Ba)	2.10	0.972	2.24	0.898	2.09	100.0	---
Cadmium, Leachable (Cd)	0.0400	0.0200	0.0390	0.0260	0.0220	1.0	0.066
Chromium, Leachable (Cr)	0.453	0.379	0.516	0.422	0.430	5.0	5.2
Lead, Leachable (Pb)	<0.02	<0.02	<0.02	<0.02	<0.02	5.0	0.51
Mercury, Leachable (Hg)	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	0.2	---
Selenium, Leachable (Se)	<0.08	<0.08	<0.08	<0.08	<0.08	1.0	---
Silver, Leachable (Ag)	<0.003	<0.003	<0.003	<0.003	<0.003	5.0	0.072
Nickel, Leachable (Ni)	<0.03	<0.03	<0.03	<0.03	<0.03	---	0.32
pH after TCLP extraction	9.3	9.5	9.4	9.5	9.5	---	---

TABLE 2-4

UCS RESULTS (psi)
CLARIIER - LIME/CEMENT/FLYASH

Mix	48 Hrs	7-Day #1	7-Day #2
Batch 1	439	331	604
Batch 2	>625	606	>637
Batch 3	229	264	206
Batch 4	>631	>637	>637
Batch 5	571	>637	>637

TABLE 2-5

DURABILITY TEST RESULTS
CLARIFIER - LIME/CEMENT/FLYASH

	Average	FREEZE/THAW		WET/DRY	
	UCS Before Durability Testing (psi)	% Wt. Loss	UCS After Durability Test (psi)	% Wt. Loss	UCS After Durability Test (psi)
Batch 1	468	31	523	NA	Failed Cycle 2
Batch 2	622	27	226	NA	Failed Cycle 2
Batch 3	235	27	344	NA	Failed Cycle 3
Batch 4	>637	NA	Failed Cycle 8	NA	Failed Cycle 2
Batch 5	>637	NA	Failed Cycle 12	NA	Failed Cycle 1

NOTE: All cylinders passed the required 12 cycles for the durability test unless otherwise noted.

All testing was performed on 12 day cured samples.

% weight loss is approximated and is a combination of any moisture loss plus mass loss as a result of the brushing after each cycle.

3.0 STABILIZATION OF CLARIFIER WITH LIME/CEMENT/FLYASH AND PLASTIC FIBER FORMULATION

3.1 PURPOSE

The purpose of this series of tests was to analyze the effect of adding plastic fibers to the previously established mixtures of lime/cement/flyash. The same 2 by 2 factorial experiment described in Section 2.0 was incorporated for these mixtures. The plastic fibers should act as a reinforcing additive preventing the cylinders from falling apart if cracking occurs during durability testing.

3.2 PROCEDURE

Initially, a sludge mixture was made using 5 parts clarifier sludge and 1 part clarifier water (by volume). This ratio of the "sludge mixture" was held constant for all 5 batches. The percent solids of the "sludge mixture" was approximately 25.3%. The batches to be mixed are defined in Table 3-1 with Batch #5 being the previously defined center point.

Hydrated lime (35 grams) was used to achieve a pH of 11.5 to 12 for the sludge mixture. Following the pH adjustment, Type V cement, Type C "comanche" flyash and plastic fibers were added. The plastic fibers were added at approximately 0.025% of the total weight of the pozzolan materials in the mixture. The mixture was wet mixed for 5 minutes with a HOBART mixer.

Six cylinders were made for each batch. After curing, products were tested for UCS using ASTM Method C39-86. TCLP extraction and metals analyses were conducted. The freeze/thaw and wet/dry durability test procedures were modified to enable the testing to be completed in an expedient manner because of schedule constraints. The control cylinder (i.e., volume and moisture loss specimen) was omitted, thus only one cylinder was submitted for each test. The dimension measurements and the weighing of the cylinders were omitted. Brushing of the cylinders was done as specified in the methods. The freeze/thaw procedure was accelerated by reducing the time of freezing from 24 hours/cycle to 12 hours/cycle. The wet/dry procedure was accelerated by decreasing the drying period from 42 hours to 19 hours and the time of submergence from 5 hours to 4 hours. Table 3-2 defines curing times and the cylinders required for each test.

TABLE 3-1

BATCHES FOR 207C STABILIZATION
LIME/CEMENT/FLYASH + PLASTIC FIBERS

	Sludge Mixture	Cement	Flyash	Plastic Fibers
Batch 1	2000g	625g	2084g	0.75g
Batch 2	2000g	1041g	2084g	0.87g
Batch 3	2000g	625g	1250g	0.52g
Batch 4	2000g	1041g	1250g	0.64g
Batch 5	2000g	833g	1667g	0.69g

TABLE 3-2

SUMMARY OF TESTING SCHEDULES
207C - LIME/CEMENT/FLYASH + PLASTIC FIBERS

Curing Time	UCS	TCLP (Metals)	Freeze/Thaw + UCS	Wet/Dry + UCS
48 hrs*	1	1	1	1
7-day	2	NA	NA	NA
14-day	1	NA	NA	NA
28-day	1	NA	NA	NA

* Accelerated Cure
NA - Not Analyzed

3.3 RESULTS

This section will provide the results for TCLP analysis, UCS, and durability testing.

The TCLP results are provided in Table 3-3. The results in Table 3-3 indicated that all of the metal analysis results are below their LDR and Toxicity Characteristic Levels with the exception of cadmium in Batches 3 and 4. The pH of the TCLP extraction ranged between 8.0 and 9.6. Batch 3 had a pH of 9.2 and Batch 4 had a pH of 8.0 which corresponded to a cadmium concentration of 0.068 mg/l and 0.922 mg/l, respectively. When these results are compared to the same batch numbers in Section 2.3 the results vary substantially. The results from Section 2.3 indicate that Batch 3 had a pH of 9.4 with a cadmium concentration of 0.039 mg/l and Batch 4 had a pH of 9.5 with a cadmium concentration of 0.026 mg/l. The variation in these concentrations seem to be large considering that the quantity of pozzolans and lime are identical for each corresponding batch.

The UCS results are provided in Table 3-4. The UCS results indicate that all of the cylinders became hard with the strengths ranging from approximately 100 psi to greater than 637 psi. The maximum strength which can be determined in the laboratory is 637 psi. The majority of the cylinders achieved strengths of approximately 600 psi with the exception of the cylinders from Batch 3 which had the smallest quantity of pozzolans added to the mixture.

The durability testing is summarized in Table 3-5. Review of this table indicates that Batches 1, 2, and 5 passed the freeze/thaw testing. The UCS data indicated that the strength of the cylinders decreased by 30 to 48 percent after the durability testing.

Batches 3 and 4 failed the freeze/thaw testing in Cycle 8 and 12, respectively. The failure of Batches 3 and 4 is likely related to the quantity of pozzolans added. These cylinders contained the least amount of total pozzolans.

All of the cylinders failed in the wet/dry testing very early in the testing. The reason for this failure may be related to the sulfate present in the clarifier sludge having adverse reactions with components in the Type C flyash. At the elevated temperatures (70°C) which the test is conducted, during the drying cycle, the sulfate reacts with components of the flyash to form an unstable product and subsequent failure of the test. Additionally, the high water to pozzolan ratio may have contributed to the cylinders failing the wet/dry tests.

TABLE 3-3

48-Hr ACCELERATED CURE TCLP RESULTS (mg/L)
CLARIFIER - LIME/CEMENT/FLYASH + PLASTIC FIBERS

ANALYTE	BATCH #1	BATCH #2	BATCH #3	BATCH #4	BATCH #5	TOXICITY CHARACTERISTIC STANDARD	NONWASTEWATER LDR STANDARD
Arsenic, Leachable (As)	0.100	0.0730	0.0820	0.0870	0.0710	5.0	---
Barium, Leachable (Ba)	2.30	0.955	2.16	1.03	2.19	100.0	---
Cadmium, Leachable (Cd)	0.0290	0.0230	0.0680	0.922	0.0120	1.0	0.066
Chromium, Leachable (Cr)	0.453	0.379	0.560	0.406	0.429	5.0	5.2
Lead, Leachable (Pb)	<0.02	<0.02	<0.02	<0.02	<0.02	5.0	0.51
Mercury, Leachable (Hg)	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	0.2	---
Selenium, Leachable (Se)	<0.08	<0.08	0.0830	<0.08	0.0830	1.0	---
Silver, Leachable (Ag)	<0.003	<0.003	<0.003	<0.003	<0.003	5.0	0.072
Nickel, Leachable (Ni)	<0.03	<0.03	<0.03	0.0630	<0.03	---	0.32
pH after TCLP extrn.	9.1	9.3	9.2	8.0	9.6	---	---

TABLE 3-4

UCS RESULTS (psi)
CLARIFIER - LIME/CEMENT/FLYASH + PLASTIC FIBERS

Mix	48 Hr.	7-Day #1	7-Day #2
Batch 1	241	>637	>637
Batch 2	631	>637	>637
Batch 3	107	233	312
Batch 4	>631	>637	>637
Batch 5	>631	>637	>637

* Accelerated Cure
Dup. - Duplicate

TABLE 3-5

DURABILITY TEST RESULTS
CLARIFIER - LIME/CEMENT/FLYASH + PLASTIC FIBERS

	Average UCS Before Durability Testing (psi)	FREEZE/THAW		WET/DRY	
		% Wt. Loss	UCS After Durability Test (psi)	% Wt. Loss	UCS After Durability Test (psi)
Batch 1	>637	29	446	NA	Failed Cycle 2
Batch 2	>637	24	322	NA	Failed Cycle 2
Batch 3	273	NA	Failed Cycle 8	NA	Failed Cycle 3
Batch 4	>637	NA	Failed Cycle 12	NA	Failed Cycle 1
Batch 5	>637	31	389	NA	Failed Cycle 2

NOTE: All cylinders passed the required 12 cycles for the durability test unless otherwise noted.

All testing was performed on 48-hour accelerated cure samples.

% weight loss is approximated and is a combination of any moisture loss plus mass lost as a result of the brushing after each cycle.

4.0 STABILIZATION OF CLARIFIER LIME/CEMENT/FLYASH + SODIUM SILICATE

4.1 PURPOSE

The purpose of these tests was to analyze the effect of adding silicates to the previously established mixtures of lime/cement/flyash further utilizing factorial experimentation (3x2). This experiment is conceptually illustrated in Figure 4-1.

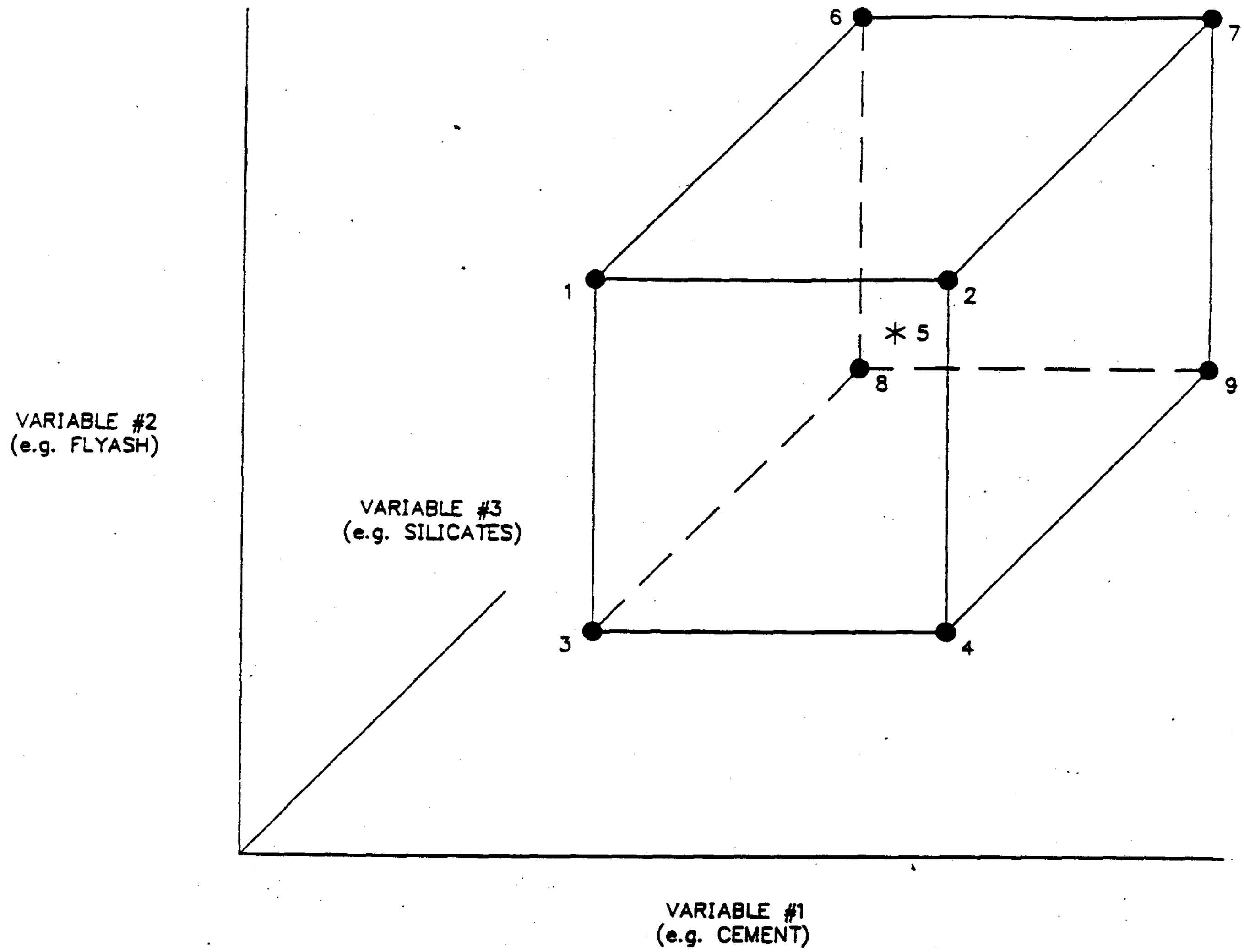
4.2 PROCEDURE

Initially, a sludge mixture was made using 5 parts clarifier sludge and 1 part clarifier water (by volume). This ratio of the "sludge mixture" was held constant for all 9 batches. The percent solids of the "sludge mixture" was approximately 25.3%. The batches mixed are defined in Table 4-1 with Batch #5 being the previously defined center point.

Hydrated lime (20 grams) was used to achieve a pH of 11.5 to 12 for the sludge mixture. Following the pH adjustment, Type V cement, Type C "Comanche" flyash, and silicates were added. The mixtures incorporated silicates, as sodium silicate at 5% to 15% of the weight of the cement in the mixture. The mixture was wet mixed for 5 minutes in a HOBART mixer.

Six cylinders were made for each batch. After curing, products were tested for UCS using ASTM Method C39-86. TCLP extraction and metals analysis were also conducted. The freeze/thaw and wet/dry durability test procedures were modified to enable the testing to be completed in an expedient manner because of schedule constraints. The control cylinder (i.e., volume and moisture control specimen) was omitted, thus only one cylinder was submitted for each test. The dimension measurements and the weighing of the cylinders were omitted. Brushing of the cylinders was done as specified in the methods. The freeze/thaw procedure was accelerated by reducing the time of freezing from 24 hours/cycle to 12 hours/cycle. The wet/dry procedure was accelerated by decreasing the drying period from 42 hours to 19 hours and the time of submergence from 5 hours to 4 hours. Table 4-2 defines curing times and the cylinders required for each test.

FIGURE 4—1



LEGEND

* CENTER POINT CONCENTRATION

● CONCENTRATIONS ± %
AROUND CENTER POINT

TABLE 4-1

BATCHES FOR CLARIFIER STABILIZATION
LIME/CEMENT/FLYASH + SODIUM SILICATE

	Sludge Mixture	Cement	Flyash	Silicate	Lime
Batch 1	2000 g	536.0 g	1625.0 g	26.8 g	20 g
Batch 2	2000 g	837.5 g	1625.0 g	41.9 g	20 g
Batch 3	2000 g	536.0 g	975.0 g	26.8 g	20 g
Batch 4	2000 g	837.5 g	975.0 g	41.9 g	20 g
Batch 5	2000 g	670.0 g	1300.0 g	67.0 g	20 g
Batch 6	2000 g	536.0 g	1625.0 g	80.4 g	20 g
Batch 7	2000 g	837.5 g	1625.0 g	125.6 g	20 g
Batch 8	2000 g	536.0 g	975.0 g	80.4 g	20 g
Batch 9	2000 g	837.5 g	1625.0 g	125.6 g	20 g

TABLE 4-2

SUMMARY OF TESTING SCHEDULES
CLARIFIER - LIME/CEMENT/FLYASH + SODIUM SILICATE

Curing Time	UCS	TCLP (Metals)	Freeze/Thaw + UCS	Wet/Dry + UCS
48 Hrs	1	1	NA	NA
7-Day	2	NA	NA	NA
14-Day	NA	NA	1	1

NA - Not Analyzed

4.3 RESULTS

This section will provide the results for UCS and durability testing.

The TCLP results are not provided in this section because the data is inaccurate. The TCLP results are not valid because of incorrect interpretation of the TCLP Method by the laboratory technician conducting the analysis. Upon receiving the results, discussions with the laboratory determined that the laboratory technician was adding more acetic acid to prepare the extraction fluid then what was specified by the method. The TCLP Method indicates that 5.7 ml of acid should be used in preparing the extraction fluid. The method states that the extraction fluid should be discarded if the pH is not correct (2.88 +/- 0.05 Standard Units). The technician was adding additional acid to achieve a pH of approximately 2.88 which is incorrect. The additional acid in the extraction fluid resulted in the pH of the leachate being lower then if the proper amount of acid was added. Because the pH was decreased to approximately 5.0 in the leachate, the metals became more soluble resulting in leachate concentrations that were extremely high.

UCS results are provided in Table 4-3. The UCS results indicate that all of the cylinders became hard with the strengths ranging from approximately 200 psi to greater than 637 psi. The maximum strength which can be determined in the laboratory is 637 psi. The majority of the cylinders achieved strengths of approximately 600 psi with the exception of the cylinders from Batches 3 and 8 which had the smallest quantity of pozzolans added to the mixture. Cylinders from batches 1 and 6 were also lower than the others. Batches 1 and 6 have low cement and high flyash.

The durability testing is summarized in Table 4-4. Review of this table indicates that all of the cylinders failed the freeze/thaw testing. In general, it is likely that the cylinders failed the durability test because the water to pozzolan ratio was too high (W/P Ratio ranged from .69 to .99).

All of the cylinders failed in the wet/dry testing very early in the testing. The reason for this failure may be related to the sulfate present in the clarifier sludge having adverse reactions with components in the Type C flyash. At the elevated temperatures (70°C) which the test is conducted, during the drying cycle, the sulfate reacts with components of the flyash to form an unstable product and subsequent failure of the test. Additionally, the high water to pozzolan ratio may have contributed to the cylinders failing the wet/dry tests.

TABLE 4-3

USC RESULTS (psi)
CLARIFIER - LIME/CEMENT/FLYASH + SODIUM SILICATE

Mix	48 Hrs.	7-Day #1	7-Day #2
Batch 1	337	392	400
Batch 2	>637	>637	>637
Batch 3	207	304	316
Batch 4	>637	>637	>637
Batch 5	542	>637	>637
Batch 6	354	299	461
Batch 7	>637	>637	>637
Batch 8	347	293	323
Batch 9	>637	>637	>637

TABLE 4-4

DURABILITY TEST RESULTS
CLARIFIER - LIME/CEMENT/FLYASH + SODIUM SILICATE

	UCS Before Durability Testing (psi)	FREEZE/THAW		WET/DRY	
		% Wt. Loss	UCS After Durability Test (psi)	% Wt. Loss	UCS After Durability Test (psi)
Batch 1	396	NA	Failed prior to UCS after 12 cycles	NA	Failed Cycle 2
Batch 2	>637	NA	Failed Cycle 11	NA	Failed Cycle 2
Batch 3	310	NA	Failed Cycle 5	NA	Failed Cycle 2
Batch 4	>637	NA	Failed prior to UCS after 12 cycles	NA	Failed Cycle 2
Batch 5	>637	NA	Failed prior to UCS after 12 cycles	NA	Failed Cycle 2
Batch 6	380	NA	Failed No. 8	NA	Failed Cycle 2
Batch 7	>637	NA	Failed prior to UCS after 12 cycles	NA	Failed Cycle 1
Batch 8	308	NA	Failed prior to UCS after 12 cycles	NA	Failed Cycle 3
Batch 9	>637	NA	Failed prior to UCS after 12 cycles	NA	Failed Cycle 2

NOTE: All cylinders passed the required 12 cycles for the durability test unless otherwise noted.

All testing was performed on 12-day cured samples.

% weight loss is approximated and is a combination of any moisture loss plus mass loss as a result of the brushing after each cycle.

5.0 STABILIZATION OF CLARIFIER MATRIX CENTER POINTS FOR DURABILITY TESTING WITH LIME/CEMENT/FLYASH + ADDITIVE

5.1 PURPOSE

The purpose of these tests was to analyze the durability effect of additives to the center point mixture of lime/cement/flyash. Three batches were mixed. These three batches are the center points from previous tests. These batches served as quality control checks for consistency thus duplicating some TCLP and UCS measurements. The emphasis was on the durability of the cylinders in the hope these results could be extrapolated throughout their respective matrices.

5.2 PROCEDURE

Initially a sludge mixture is to be made using 5 parts clarifier sludge and 1 part clarifier water (by volume). This ratio of the "sludge mixture' was held constant for all three batches. The percent solids of the "sludge mixture' was approximately 25.3%. The batches mixed are defined in Table 5-1.

Hydrated lime (20 grams) was used to achieve a pH of 11.5 to 12 for the sludge mixture. Following the pH adjustment, the Type V cement, Type C "Comanche" flyash and additive (if required) was added. The mixture incorporating silicate, as sodium silicate, was added at 10% of the weight of the cement in the mixture. The mixture incorporating plastic fibers was added at approximately 0.025% of the total weight of the pozzollanic material in the mixture. The mixture was wet mixed for 5 minutes in a HOBART mixer.

Six cylinders were made for each batch. After curing, products were tested for UCS using ASTM Method C39-86. TCLP extraction and metals analysis were also conducted. The freeze/thaw and wet/dry durability test procedures were modified to enable the testing to be completed in an expedient manner because of schedule constrains. The control cylinder (i.e., volume and moisture control specimen) was omitted, thus only one cylinder was submitted for each test. The dimension measurements and the weighing of the cylinders were omitted. Brushing of the cylinders was done as specified in the methods. The freeze/thaw procedure was accelerated by educing the time of freezing from 24 hours/cycle to 12 hours/cycle. The wet/dry procedure was accelerated by decreasing the drying period from 42 hours to 19 hours and the time of submergence from 5 hours to 4 hours. Table 5-2 defines curing times and the cylinders required for each test.

TABLE 5-1

BATCHES FOR CLARIFIER CENTER POINT STABILIZATION LIME/CEMENT/FLYASH + ADDITIVE

	Sludge Mixture	Cement	Flyash	Additive	Lime
Batch 1	2000 g	670.0 g	1300.0 g	NA	20 g
Batch 2	2000 g	670.0 g	1300.0 g	67.0 g silicate	20 g
Batch 3	2000 g	670.0 g	1300.0 g	0.55 g fibers	20 g

NA - Not Added

TABLE 5-2

SUMMARY OF TESTING SCHEDULES FOR CENTER POINT STABILIZATION OF CLARIFIER LIME/CEMENT/FLYASH + ADDITIVE

Curing Time	UCS	TCLP (Metals)	Freeze/Thaw + UCS	Wet/Dry + UCS
48 Hrs	1	1	1	1
7-Day	1	NA	NA	NA
28-Day	1	NA	NA	NA

NA - Not Analyzed

5.3 RESULTS

This section will provide the results for UCS and durability testing.

The TCLP results are not provided in this section because the data is inaccurate. These results are not valid because of incorrect interpretation of the TCLP method by the laboratory technician conducting the analysis. Upon receiving the results, discussions with the laboratory determined that the laboratory technician was adding more acetic acid to prepare the extraction fluid than what was specified by the method. The TCLP Method indicates that 5.7 ml of acid should be used in preparing the extraction fluid. The method states that the extraction fluid should be discarded if the pH is not correct (2.88 +/- 0.05 Standard Units). The technician was adding additional acid to achieve a pH of approximately 2.88 which is incorrect. The additional acid in the extraction fluid resulted in the pH of the leachate being lower then if the proper amount of acid was added. Because the pH was decreased to approximately 5.0 in the leachate, the metals became more soluble resulting in leachate concentrations that were very high above the LDR standards.

UCS results are provided in Table 5-3. The UCS results indicate that all of the cylinders became hard with strengths greater than 637 psi. The maximum strength which can be determined in the laboratory is 637 psi.

Durability testing is summarized in Table 5-4. Review of this table indicates that cylinders from Batches 1 and 2 failed the freeze/thaw testing. Batch 3 passed the durability test, however, the UCS result indicated that the strength was significantly reduced. It is likely that the cylinders failed the durability test because the water to pozzolan ratio was too high (W/P Ratio ranged from .69 to .99).

All of the cylinders failed in the wet/dry testing very early in the testing. The reason for this failure may be related to the sulfate present in the clarifier sludge having adverse reactions with components in the Type C flyash. At the elevated temperatures (70°C) which the test is conducted, during the drying cycle, the sulfate reacts with components of the flyash to form an unstable product an subsequent failure of the test. Additionally, the high water to pozzolan ratio may have contributed to the cylinders failing the wet/dry tests.

TABLE 5-3

UCS RESULTS (psi)
CLARIFIER - LIME/CEMENT/FLYASH + ADDITIVE

Mix	48 Hrs.	7-Day	28-Day
Batch 1	>637	>637	NA
Batch 2	>637	>637	NA
Batch 3	>637	>637	NA

TABLE 5-4

DURABILITY TEST RESUTLS
CLARIFIER - LIME/CEMENT/FLYASH + ADDITIVE

	UCS Before Durability Testing (psi)	FREEZE/THAW		WET/DRY	
		% Wt. Loss	UCS After Durability Test (psi)	% Wt. Loss	UCS After Durability Test (psi)
Batch 1	>637	NA	Failed Cycle 12	NA	Failed Cycle 1
Batch 2	>637	NA	Failed Cycle 8	NA	Failed Cycle 1
Batch 3	>637	37	169	NA	Failed Cycle 1

NOTE: All cylinders passed the required 12 cycles for the durability test unless otherwise noted.

All testing was performed on 48-hour accelerated cure samples.

% weight loss is approximated and is a combination of any moisture loss plus mass lost as a result of the brushing after each cycle.

6.0 CONCLUSIONS

This section will provide the conclusions derived from this testing and provide recommendations for treatability work involving the combination of 207C slurry with the clarifier contents. The following are major conclusions based on the data provided in this report:

- The additives tested (i.e., plastic fibers and sodium silicate) did not appear to provide significant improvement for durability or strength when compared to the lime/cement/flyash mixture.

- All of the mixtures with Type V cement and Type C flyash at a center point ratio of 1 to 2 achieved UCS result of at least 100 psi and had no free water present after curing. The water to pozzolan (cement plus flyash) ratios that were tested are as follows:

  Batch 1 = 0.69
  Batch 2 = 0.61
  Batch 3 = 0.99
  Batch 4 = 0.82
  Batch 5 = 0.76

- The formulations prepared were not adequate for the freeze/thaw and wet/dry durability testing. Very few cylinders successfully passed the freeze/thaw test and none passed the wet/dry test. The reason for the failures in the freeze/thaw testing is believed to be related to insufficient quantities of pozzolans. Testing on other waste streams (207C slurry and 207 A/B sludge) indicate that the water to pozzolan ratio should be less than .50 to successfully pass the durability testing. Failure for the wet/dry testing is likely related to the high water to pozzolan ratio and also the presence of sulfate in the clarifier sludge. The sulfate may react with components of the Type C flyash during the drying cycle of the wet/dry test resulting in an unstable product and subsequent failure of the test.

- The results of the TCLP analysis for the lime/cement/flyash formulation using 0.8% to 1.0% lime by weight of the total end product successfully met all Land Disposal Restriction criteria. TCLP results for the other formulations are not valid because of errors in the laboratory procedure for TCLP extraction which resulted in an apparent failure of the LDR criteria. The results of the TCLP analysis which failed should be disregarded.

RECOMMENDATIONS

1. Future formulations with the clarifier should use a water to pozzolan ratio greater than .50.

2. The quantity of lime will be increased to 1.4% of the total weight of the end product which should provide a safety margin for the TCLP analysis.

3. The formulations devised for the 207C material combined with the clarifier material should include a mixture which only uses Type V cement to avoid failure in the wet/dry test because of sulfate reacting with Type C flyash.

ATTACHMENT A-4

MEMORANDUM, R. SIMCIK TO T. BITTNER
CYANIDE OXIDATION TEST RESULTS FOR POND 207C

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-03-92-

TO:	**TED BITTNER**	**DATE:**	**MARCH 15, 1992**
FROM:	**ROB SIMCIK**	**cc:**	**DISTRIBUTION**

SUBJECT: CYANIDE OXIDATION TEST RESULTS FOR POND 207C
EG&G ROCKY FLATS SOLAR POND STABILIZATION PROJECT
REVISION NO. 1

1.0 PURPOSE

The characterization data for Pond 207C indicate that the total cyanide concentration in the water is above the LDR standard for wastewater and that the total cyanide concentration in the sludge is below the LDR standard for non-wastewater (see attached memo). The characterization data for Pond 207C waterS indicates that the total cyanide concentration ranges from 3.3 to 20 mg/l with an average concentration of 7.7 mg/l. The LDR standard for total cyanide is 1.2 mg/l for F006 listed wastes, which is applicable for Pond 207C.

Testing was conducted to oxidize the cyanide in Pond 207C using calcium hypochlorite, chlorine dioxide, and hydrogen peroxide. The testing was conducted initially on 207C slurry (5 parts water, 1 part crystal, and 1 part silty sludge), however; as the testing progressed, tests were conducted only on the water to conserve quantities of silty sludge and crystal.

1.1 ALKALINE CHLORINATION

The oxidation of cyanide with calcium hypochlorite and chlorine dioxide is commonly referred to as alkaline chlorination. Typically, this process is conducted in two steps. In the first step, CN is oxidized to cyanate, and in the second step, cyanate is oxidized to carbon dioxide and nitrogen. The first step is conducted at a pH of 9.0 to 10.0, and the second step is conducted at a pH of 8.0 to 8.5. In many cases, only oxidation to cyanate is required to achieve discharge limits.

The stoichiometric requirement for the oxidation of cyanide to cyanate is approximately 2.7 mg/l of chlorine per mg/l of CN^-. To oxidize cyanate to completion, 2.4 mg/l of chlorine per mg/l of CNO^- is required. Therefore, a maximum chlorine dosage of approximately <u>119</u> mg/l should be sufficient to oxidize the maximum total cyanide to cyanate. The dosage of chlorine should be based on the total cyanide concentration because complexed cyanide should dissociate to maintain equilibrium as the free cyanide is oxidized.

1.1.1 Cyanide Oxidation With Calcium Hypochlorite

Tests were conducted to determine if chlorination of 207C composite waste using calcium hypochlorite would sufficiently oxidize the cyanide present in the pond, and if so, the optimal conditions. Calcium hypochlorite dosage, pH, and retention time were the parameters evaluated in the oxidation testing.

The experiments were designed to evaluate calcium hypochlorite concentrations from approximately 100 ppm to 10,000 ppm; varying the retention time from 30 minutes to 24 hours; and varying the pH from 9.0 to 11.0. Four tests were conducted to determine the effect of varying the above parameters. Each test is briefly described below:

- Test #1 - This test was conducted on 1/09/92. The testing parameters were calcium hypochlorite concentration, pH, and retention time. The retention time was varied from 15 to 30 minutes, the calcium hypochlorite dosage was varied from 100 to 5000 ppm, and the pH was varied from 9.0 to 11.0.

- Test #2 - This test was conducted on 1/10/92. This test used a 30 minute retention time, a pH of 9.0 & 10.0, and calcium hypochlorite concentrations of 100 ppm & 500 ppm.

- Test #3 - This test was conducted on 1/14/92. This test used a 30 minute retention time with the pH varying from 9.0 to 10.0, and calcium hypochlorite concentrations of 5000 ppm and 10,000 ppm.

- Test #4 - This test was conducted on 1/16/92. This test varied retention time with a constant pH and calcium hypochlorite concentrations of 1000 ppm and 5000 ppm.

1.1.2 Cyanide Oxidation With Chlorine Dioxide

The testing with calcium hypochlorite was unsuccessful in achieving the LDR standards for total cyanide. Because chlorine dioxide is a stronger oxidant than calcium hypochlorite, tests were conducted to determine if a stronger oxidant would oxidize the total cyanide. Testing with chlorine dioxide was conducted using a concentration of 1500 ppm at a pH of 9.7. This concentration is well above the calculated stoichiometric requirement for oxidation of all total cyanide. Samples were collected after 1 hour and 24 hours of reaction time.

1.2 HYDROGEN PEROXIDE OXIDATION

The tests using alkaline chlorination were unsuccessful in oxidizing the cyanide; therefore, hydrogen peroxide was tested to determine its ability to oxidize the cyanide. Oxidation with hydrogen peroxide is generally conducted at a pH of 8.5 to 10.0.

The cyanide is first oxidized to cyanate which is then slowly hydrolyzed to form carbon dioxide and ammonia. This reaction rate is greatly increased by traces of catalytic metals, such as copper and iron. Typically, 1.3 mg/l of hydrogen peroxide is required to oxidize 1.0 mg/l of cyanide.

Three separate tests were conducted using hydrogen peroxide. The testing evaluated hydrogen peroxide, hydrogen peroxide with cupric sulfate, and hydrogen peroxide with ferrous sulfate (Fenton's Reagent).

2.0 PROCEDURE

The initial testing for cyanide oxidation was conducted on the combined material slurried at a 1/1/5 ratio of silty sludge, crystal, and pond water, respectively. As testing proceeded and it was determined that more testing was needed because of the unsuccessful results, testing was conducted only on the water from Pond 207C. The decision to conduct tests on only water was made to avoid using large quantities of the slurry which was needed for testing of the stabilization formulas.

Prior to oxidation, total and amenable cyanide analyses were performed on the composited sludge or water and recorded as the baseline concentration. Typically, a baseline analysis was conducted at the beginning of each separate experiment. A summary of the baseline results are shown in Table 2-1.

The data in Table 2-1 indicate that there is significant variability in the cyanide analysis, which is likely caused by the cyanides being complexed with metals and/or the high concentration of dissolved solids in 207C water. The analysis for weak and dissociable cyanide (W&D) may be a more accurate measurement of amenable cyanide, which typically was reported as a negative number in the characterization report. Negative numbers are commonly associated with amenable cyanide analysis when cyanides are complexed with metals. The baseline average concentration for total cyanide is 5.4 mg/l.

2.1 CYANIDE OXIDATION WITH CALCIUM HYPOCHLORITE

TEST 1

Three experiments were performed using the following concentrations of calcium hypochlorite: 100 ppm, 1000 ppm, and 5000 ppm. The calcium hypochlorite had a purity of 65 %. In each experiment, the pH was adjusted using hydrochloric acid or sodium hydroxide to achieve pH values of 9.0, 9.5, 10.0, 10.5, and 11.0. Each experiment was designed for sample collection for analysis after 15 and 30 minutes of retention time. After collecting the sample, the oxidation reaction was intended to be stopped by addition of sodium thiosulfate. To determine the amount of sodium thiosulfate to be added, residual chlorine was monitored by using a chlorine probe.

When the samples were submitted for analysis, the laboratory technician checked for residual chlorine using potassium iodide (KI) paper and found that all of the samples contained chlorine. Thus, the reactions had not been stopped after the intended reaction time. The decision was made to forego analysis because all the reaction times could not be determined (Note: at that time it was believed that the oxidation of cyanide would be relatively straight forward). Based on the observations of the technician it was realized that the chlorine probe was unable to provide accurate results because of the high dissolved solids concentrations. A determination was made to use both KI paper and ortho-toluidine to assure no residual chlorine would be present in samples generated in the future.

Because of the concern that the reaction time was not known, not all of the samples were analyzed. Three of the samples were analyzed when they were submitted and five samples were analyzed at a later date (approximately 11 days later) to determine if any oxidation occurred. These samples were analyzed after testing determined that the cyanide was not simple to oxidize and that a long reaction time might be required if the cyanides are complexed with metals. These results are provided in Section 3.0. Table 2-2 summarizes the trials conducted during Test 1.

TEST 2

In this experiment the retention time was held constant at 30 minutes by stopping the oxidation reaction with sodium thiosulfate. The 207C composite sludge pH and concentration of calcium hypochlorite were varied from a starting point of 10.3 to the desired pH using hydrochloric acid. The trials performed are as shown in Table 2-3. The results from the total and amenable cyanide analyses are provided in Section 3.0.

TEST 3

In this experiment the retention time was held constant at 30 minutes while varying the pH and concentration of calcium hypochlorite. The initial pH of the 207C composite was 10.1. Hydrochloric acid was used to lower the pH to the desired level. The experiment trial runs are as shown in Table 2-4. The results from the total and amenable cyanide analysis are provided in Section 3.0.

TEST 4

This test used 207C pond water with an initial pH of 9.8, which was not adjusted. Two experiments were performed at calcium hypochlorite concentrations of 1000 ppm and 5000 ppm. The reaction times tested were 30 minutes, 90 minutes, 180 minutes, and 24 hours. The reaction was stopped using sodium thiosulfate. The samples were analyzed for total and amenable cyanide. The results are provided in Section 3.0. Table 2-5 summarizes the trials conducted during Text 4.

2.2 OXIDATION USING CHLORINE DIOXIDE

This experiment was conducted to determine the effectiveness of chlorine dioxide to oxidize the cyanide found in Pond 207C water. Retention times of 1 hour and 24 hours were tested with all other variables held constant. The 207C pond water had an initial pH of 10.2.

Because of the difficulties in achieving reproducible results, three analytical testing methods were used to determine the concentration of cyanide present. The methods are: ASTM D2036 Total and Amenable Cyanide Method, EPA 335.2 Total and Amenable Cyanide Method, and ASTM D2036 Weak & Dissociable Cyanide Method. The 207C pond water was submitted for baseline analysis using all three testing procedures. The results are shown in Table 2-1.

A saturated solution of chlorine dioxide was prepared at a concentration of 3000 ppm. The chlorine dioxide solution (600 ml) was added to 600 ml of 207C water to obtain a concentration of 1500 ppm chlorine dioxide. The pH of the mixture dropped from 10.2 to 9.3 when the chlorine dioxide solution was added to the pond water. To increase the pH, 42 ml of 1N sodium hydroxide was added which increased the pH to 9.7. After the addition of the sodium hydroxide the solution became very cloudy and a significant amount of fine white precipitate was formed. Samples were submitted after 1 hour and 24 hours of contact time with constant mixing. The results are provided in Section 3.0.

2.3 CYANIDE OXIDATION WITH HYDROGEN PEROXIDE

Three tests were conducted to evaluate hydrogen peroxide for oxidizing cyanide in Pond 207C water. The first test used hydrogen peroxide at a concentration of 1000 ppm. The second experiment evaluated hydrogen peroxide with cupric sulfate to enhance the reaction. The third experiment used hydrogen peroxide and ferrous sulfate at a pH of 5.0. The third experiment is representative of Fenton's Reagent, which is a strong oxidant.

TEST 1

Six (6) ml of 50% hydrogen peroxide was added to 3 liters of 207C water to obtain a concentration of 1000 ppm of hydrogen peroxide. Samples were collected after 1 hour and 24 hours of reaction time. The results of this testing are provided in Section 3.0.

TEST 2

Four liters of 207C Pond Water were collected and a 1-liter aliquot was submitted for baseline cyanide analysis using ASTM D2036 by colorimetric and titration analysis for both total and amenable cyanide. The results are provided in Section 3.0.

The remaining 3 liters of sample were divided into 2 liter and 1 liter aliquots which were used for Tests 2 and 3, respectively. The pH of the 2-liter sample was adjusted to 10.0 with 12 grams of hydrated lime. Hydrogen peroxide (50%) was added at a concentration of 2000 ppm (8.0 ml) and cupric sulfate was added at a concentration of 50 ppm (100 mg). The mixture was stirred continuously and samples were removed after 1 hour and 24 hours. The samples were submitted for cyanide analysis using ASTM D2036 colorimetric and titration method for both total and amenable cyanide. The results are provided in Section 3.0.

TEST 3

This test evaluated the use of Fenton's Reagent, a powerful oxidant, to destroy the cyanide in the 207C Pond water. Fenton's chemistry occurs at a pH of 5.0 when hydrogen peroxide is mixed with ferrous sulfate. The pH was adjusted by adding 19 ml of sulfuric acid to the 1 liter sample of 207C pond water. Hydrogen peroxide (50% solution) was added to achieve a concentration of 2000 ppm (4 ml) and ferrous sulfate was added to a concentration of 150 ppm (150 mg). The mixture was stirred continuously and samples were collected after 1 and 24 hours. The samples were submitted for total and amenable cyanide analysis. The results are provided in Section 3.0.

3.0 RESULTS

The results from the cyanide oxidation tests are provided in the following section. The results from the cyanide analysis indicate that the sample matrix causes interferences with the analytical procedure. The data reported from the laboratory commonly have notes on those samples which were used for matrix spikes indicating that there are matrix interferences.

3.1 CYANIDE OXIDATION RESULTS USING CALCIUM HYPOCHLORITE

TEST 1

The results for Test 1 are shown in Table 3-1. These results are somewhat ambiguous because the oxidation reaction was not stopped at the proper time because of interferences with the chlorine probe. Although the exact reaction time for each test is not known, it is greater than 24 hours in all cases. The results indicate that the LDR standards could not be achieved under the conditions that were tested. The dosages of calcium hypochlorite were above the required stoichiometric concentration to oxidize the cyanide under ideal conditions. Review of the data in Table 3-1 suggests that a reduction in the cyanide concentration occurred when compared to the average baseline concentration. However, since there was no baseline analysis performed at the time the samples were submitted, an exact determination of the destruction of cyanide can not be made. When the remaining tests are reviewed it will become apparent that the cyanide is not oxidized and differences in the cyanide concentrations are likely a result of analytical variances.

TEST 2

Test 2 was conducted to repeat the oxidation testing performed in Test 1. The initial testing was duplicated because of concerns in Test 1 regarding the inability to stop the cyanide oxidation. The results, provided in Table 3-2, suggest that as much as 70% of the total cyanide was reduced, although the cyanide was still above the LDR standard. However, there is also considerable variance in the final cyanide analytical data.

TEST 3

This experiment was conducted at high concentrations of calcium hypochlorite to ensure that the oxidizing agent was not the limiting factor. The results of this testing are shown in Table 3-3. The data does not indicate any significant reduction in cyanide concentrations and demonstrates the variability in the analytical results. The concentrations of cyanide were not reduced to levels below the LDR standards.

TEST 4

This test was conducted at a high concentration of calcium hypochlorite with longer retention times. The longer retention time was thought to be necessary if the cyanide was complexed with metals. The results are provided in Table 3-4. The data indicate that the analytical results are extremely variable. Samples collected after 30 and 90 minutes, at a concentration of 1000 ppm, suggest that the standard is achieved; however the same sample collected after 180 minutes and 24 hours indicate that the cyanide concentration increased from the samples collected earlier. The results that were below the LDR standards are likely analytical anomalies.

3.2 CYANIDE OXIDATION RESULTS WITH CHLORINE DIOXIDE

Chlorine dioxide was tried with the hope that a stronger oxidant would be more effective oxidizing the cyanide. Because of the 2:1 dilution after the addition of the chlorine dioxide solution, the measured cyanide concentration should be multiplied by 2 to correct for the dilution. The results are provided in Table 3-5. The results indicate that 1500 ppm chlorine dioxide with a maximum contact time of one day was unable to oxidize the cyanide to achieve the LDR standard.

Also shown in Table 3-5 are analytical results for cyanide using several different methods. Cyanide analysis using different methods was conducted to determine if a particular method would provide accurate results for amenable cyanide, which consistently produced negative values. The results demonstrate significant variability between the ASTM method and the EPA method. The weak and dissociable analysis provides a result which should be somewhat representative of amenable cyanide.

3.3 CYANIDE OXIDATION RESULTS WITH HYDROGEN PEROXIDE

Hydrogen peroxide was tested to determine if constituents in 207C pond water were interfering with the alkaline chlorination reaction. Three tests were conducted with hydrogen peroxide. The results are discussed below.

TABLE 2-1

BASELINE ANALYSIS FOR CYANIDE

MATRIX	METHOD	PROCEDURE	TOTAL CYANIDE (ppm)	AMENABLE CYANIDE (ppm)
Sludge	ASTM 2036	COLORIMETRIC	6.7	-7.2
Sludge	ASTM 2036	COLORIMETRIC	3.1	-8.7
Water	ASTM 2036	COLORIMETRIC	1.5	-29
Water	ASTM 2036	COLORIMETRIC	4.1	-130
Water	ASTM 2036	COLORIMETRIC	6.3	1.1
Water	ASTM 2036	TITRATION	5.2	< 5
Water	ASTM 2036	COLORIMETRIC	---	2.9[1]
Water	EPA 335.2	COLORIMETRIC	11	-140

(1) This represents the analytical result for a weak and dissociable cyanide which should be similar to the value for amenable cyanide. This test was conducted because of the difficulties in analyzing the waste for amenable cyanide as shown by the negative results.

TABLE 2-2

CALCIUM HYPOCHLORITE OXIDATION TEST #1

Trial #	Volume of 207C	pH	HCL Added	NaOH Added	Ca $(C10)_2$ ppm	$Ca(C10)_2$ Added
1	600 ml	9.0	40 ml	--	100	.06 g
2	600 ml	9.5	18.5 ml	--	100	.06 g
3	600 ml	11.0	--	38.5 ml	1000	.6 g
4	600 ml	9.0	38.5 ml	--	5000	3 g
5	600 ml	9.5	22 ml	--	5000	3 g
6	600 ml	10.0	7.0 ml	--	5000	3 g
7	600 ml	10.5	--	9 ml	5000	3 g
8	600 ml	11.0	--	33 ml	5000	3 g

TABLE 2-3

CALDIUM HYPOCHLORITE OXIDATION TEST #2

TRIAL #	207C VOLUME	pH	HCL ADDED	$Ca(ClO)_2$ ppm	$Ca(ClO)_2$ ADDED
1	600 ml	9.0	38 ml	100 mg/l	0.06 g
2	600 ml	10.0	5 ml	100 mg/l	0.06 g
3	600 ml	9.0	39 ml	500 mg/l	0.30 g
4	600 ml	10.0	6 ml	500 mg/l	0.30 g

TABLE 2-4

CALCIUM HYPOCHLORITE OXIDATION TEST #3

TRIAL #	VOLUME 207C	pH	HCL ADDED	$Ca(ClO)_2$ ppm	$Ca(ClO)_2$ ADDED
1	600 ml	9.0	42.5 ml	5,000	3 g
2	600 ml	9.5	17.5 ml	10,000	6 g
3	600 ml	10.0	2.5 ml	5,000	3 g
4	600 ml	9.0	48.5 ml	10,000	6 g
5	600 ml	9.5	19.5 ml	5,000	3 g
6	600 ml	10.0	4.0 ml	10,000	6 g

TABLE 2-5

CALCIUM HYPOCHLORITE OXIDATION TEXT #4

Trial #	Volume of 207C	pH	$Ca(C10)_2$ ppm	$Ca(C10)_2$ Added
1	1200 ml	9.8	1000	1.2 g
2	1200 ml	9.8	1000	1.2 g
3	1200 ml	9.8	1000	1.2 g
4	1200 ml	9.8	1000	1.2 g
5	1200 ml	9.8	5000	6 g
6	1200 ml	9.8	5000	6 g
7	1200 ml	9.8	5000	6 g
8	1200 ml	9.8	5000	6 g

TABLE 3-1

CALCIUM HYPOCHLORITE OXIDATION RESULTS, TEST #1

TRIAL #	Ca(ClO)2 (ppm)	RET. TIME	pH	TOTAL CN	AMEN. CN
LDR Limit	---	---	---	1.2	0.1
Average Baseline	NA	NA	NA	5.4	---
1	100	UNKNOWN	9.0	1.3	NR
2	100	UNKNOWN	9.5	2.6	NR
3	1000	UNKNOWN	11.0	1.9	NR
4	5000	UNKNOWN	9.0	2.8	NR
5	5000	UNKNOWN	9.5	2.9	NR
6	5000	UNKNOWN	10.0	1.8	NR
7	5000	UNKNOWN	10.5	1.8	NR
8	5000	UNKNOWN	11.0	1.9	NR

NA - not applicable
NR - no results, test not performed.

TEST 1

Test 1 used hydrogen peroxide at a concentration of 1000 ppm, which is significantly higher than the stoichiometric requirement of 26 mg/l (maximum based on 20 mg/l of cyanide). The results shown in Table 3-6 indicate that hydrogen peroxide at 1000 ppm was unable to oxidize cyanide to achieve the LDR standard over a 24-hour reaction time.

Additionally, the hydrogen peroxide was unable to oxidize the weak and dissociable cyanide. The weak and dissociable cyanide should be readily oxidized with hydrogen peroxide. This observation suggests that the high salt content of the pond water interferes with the cyanide oxidation reaction.

Table 3-6 also indicates that there was significant variability in the analysis for cyanide. The results using the EPA method and the ASTM method do not correlate well.

TEST 2

Test 2 evaluated hydrogen peroxide with cupric sulfate. The addition of cupric sulfate helps to catalyze the cyanide oxidation reaction. As in Test 1, the dosage of hydrogen peroxide is well above stoichiometric requirements, as is the dosage of cupric sulfate. The results, shown in Table 3-7 indicate that the cyanide was not oxidized to levels below the LDR standards.

Table 3-7 also provides results of cyanide analysis by colorimetric and titration (ASTM D2036). These results also demonstrate significant variability.

TEST 3

Test 3 evaluated the effect of hydrogen peroxide with ferrous sulfate, which may enhance the oxidation of cyanide at a pH of 5.0. The results of this testing, provided in Table 3-8, indicate that cyanide was not oxidized to a level below the LDR standards. As in Table 3-7, there is significant variability between the colorimetric and titration analysis methods.

4.0 CONCLUSIONS

The analytical results for total cyanide clearly indicate that the 207C Pond water is difficult to analyze due to matrix interferences which are likely attributed to the high salt content. Analysis for amenable cyanide can not accurately be conducted based on the frequency of negative values that are reported. This observation suggests that much of the cyanide is complexed with metals.

The cyanide present in Pond 207C water is extremely resistant to oxidation. Typically, alkaline chlorination is successful in reducing the concentration of cyanide; however, the tests conducted on the 207C waters did not significantly reduce the cyanide levels. Oxidation with hydrogen peroxide was also unsuccessful in reducing the levels of cyanide to below the LDR standards. Fenton's reagent, which is a very strong oxidant, was also unable to significantly reduce the cyanide concentrations. Although there was significant variability in the analytical results, the data suggests that the oxidizing agents had almost no effect on the cyanide concentration. The reason for this observation is not clear, although it is likely related to the high salt content in the pond and/or the cyanide being complexed with metals.

TABLE 3-2

CALCIUM HYPOCHLORITE OXIDATION RESULTS, TEST #2

TRIAL #	$Ca(ClO)_2$ (ppm)	RET. TIME	pH	TOTAL CN	AMEN. CN
LDR Limit	---	---	---	1.2	0.1
Baseline Test #2	NA	NA	10.1	6.7	-7.2
1	100	30 min.	9.0	3.2	0.69
2	100	30 min.	10.0	3.9	0.97
3	500	30 min.	9.0	2.0	-2.2
4	500	30 min.	10.0	2.7	0.82

NA - not applicable
NR - no results, test not performed.

TABLE 3-3

CALCIUM HYPOCHLORITE OXIDATION RESULTS TEST #3

TRIAL #	Ca(ClO)2 (ppm)	RET. TIME	pH	TOTAL CN	AMEN. CN
LDR Limit	---	---	---	1.2	0.1
Baseline Test #3	NA	NA	10.3	3.1	-8.7
1	5000	30 min.	9.0	4.5	-9.2
2	10,000	30 min.	9.5	3.8	-0.7
3	5000	30 min.	10.0	3.2	-7.7
4	10,000	30 min.	9.0	4.6	1.3
5	5000	30 min.	9.5	3.6	-9.4
6	10,000	30 min.	10.0	1.7	-19

NA - not applicable
NR - no results, test not performed.

TABLE 3-4

CALCIUM HYPOCHLORITE OXIDATION RESULTS, TEST #4

TRIAL #	$Ca(ClO)_2$ (ppm)	RET. TIME	pH	TOTAL CN	AMEN. CN
LDR Limit	---	---	---	1.6	0.1
Baseline Test #4	NA	NA	9.8	1.5	-29
1	1000	30 min.	9.8	1.1	0.063
2	1000	90 min.	9.8	0.97	-3.9
3	1000	180 min.	9.8	1.7	-1.9
4	1000	24 hrs.	9.8	2.0	-4.4
5	5000	30 min.	9.8	1.7	0.95
6	5000	90 min.	9.8	1.8	-1.2
7	5000	180 min.	9.8	1.6	-4.9
8	5000	24 hrs.	9.8	1.4	-14

NA - not applicable
NR - no results, test not performed.

TABLE 3-5

CHLORINE DIOXIDE OXIDATION RESULTS

OXIDANT	RET. TIME	CONC. (ppm)	pH	Cyanide by ASTM D2036		Cyanide by EPA 335.2		Cyanide by ASTM D2036
				Total	Amen.	Total	Amen.	Weak & Diss.
LDR Limit	---	---	---	1.2	0.1	1.2	0.1	---
Baseline	0	N/A	10.2	4.1	-130	11	-140	2.9
$C10_2$	1 hr	1500	9.7	1.8 (3.6)[1]	-99	N/A	N/A	N/A
$C10_2$	24 hrs.	1500	9.7	2.6 (5.2)[1]	-11	N/A	N/A	N/A

1 Concentration of sample should be multiplied by 2 because of the dilution from Chlorine Dioxide solution.

TABLE 3-6

HYDROGEN PEROXIDE OXIDATION RESULTS, TEST #1

OXIDANT	RET. TIME	CONC. (ppm)	pH	TOTAL & AMENABLE CYANIDE BY ASTM D2036	CYANIDE BY EPA 335.2		CYANIDE BY ASTM D2036
					TOTAL	AMEN.	WEAK & DISS.
LDR Limit	---	---	---	1.2/0.1	1.2	0.1	--
Base-line	0	NA	10.2	4.1 /-130	11	-140	2.9
H_2O_2	1 hr.	1000	10.1	0.16 /-93	NA	NA	NA
H_2O_2	24 hrs.	1000	10.1	4.3 /-11	5.9	-140	2.4

NA - not applicable

TABLE 3-7

HYDROGEN PEROXIDE OXIDATION RESULTS TEST #2

OXIDANT	RET. TIME	CONC. OF H_2O_2 AND $CuSO_4$ (ppm)	pH	CYANIDE BY ASTM D2036 COLORIMETRIC		CYANIDE BY ASTM D2036 TITRATION	
				TOTAL	AMEN.	TOTAL	AMEN.
LDR Limit	---	---	---	1.2	0.1	1.2	0.1
Baseline	0	NA	9.2	6.3	1.1	5.2	< 5
H_2O_2 & $CuSO_4$	1 HR.	2000/50	10	5.7	2.5	16	< 5
H_2O_2 & $CuSO_4$	24 HRS.	2000/50	10	5.3	0.62	5.2	< 5

NA - not applicable
NR - no results, Test not performed

TABLE 3-8

HYDROGEN PEROXIDE OXIDATION RESULTS TEST #3

OXIDANT	RET. TIME	CONC. OF H_2O_2 AND $CuSO_4$ (ppm)	pH	CYANIDE BY ASTM D2036 COLORIMETRIC		CYANIDE BY ASTM D2036 TITRATION	
				TOTAL	AMEN.	TOTAL	AMEN.
Base line	0	NA	9.2	6.3	1.1	5.2	< 5
LDR Limit	---	---	---	1.2	0.1	1.2	0.1
H_2O_2 & $FeSO_4$	1 HR.	2000/150	5.0	4	5.9	10	-5.2
H_2O_2 & $FeSO_4$	24 HRS.	2000/150	5.0	3.3	-390	16	-340

NA - not applicable
NR - no results, test not performed

ATTACHMENT A-5

MEMORANDUM, R. NINESTEEL TO T. BITTNER
POND/CLARIFIER SLUDGE GEOTECHNICAL DATA -
MODIFIED METHOD

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-05-92-24

TO: TED BITTNER

DATE: MAY 13, 1992

FROM: RICH NINESTEEL

cc: DISTRIBUTION

SUBJECT: ROCKY FLATS SOLAR POND PROJECT
POND/CLARIFIER SLUDGE GEOTECHNICAL
DATA - MODIFIED METHOD

Introduction

The purpose of this memorandum is to present the pond and clarifier sludge geotechnical characterization data using the modified methods presented in the Brown & Root interoffice memorandum from J. H. Templeton to W. C. Henderson dated September 17, 1991 (Attachment 1). These data were not reported in the Pond Sludge and Clarifier Waste Characterization Report (Combined Deliverable 224A and 224E), which presented data using the analytical methods originally proposed for the characterization test.

Sample Collection

The Sampling and Analysis Plan for the pond wastes proposed a series of geotechnical analyses for the pond sludges. After the samples had been collected and laboratory analyses had been initiated, additional and/or modified geotechnical analyses were requested by Brown & Root. Insufficient sample was available in the laboratory to perform the requested analyses, therefore, additional sampling was necessary to provide the required sample size. The sampling took place September 24-27, 1991. The samples that were collected are summarized in Table 1, and the field notes for this sampling round are in Appendix C of Deliverable 224A/224E, the Pond Sludge and Clarifier Waste Characterization Report (see field note pages 47-57).

Analytical Methods

Considerable difficulty was encountered in the laboratory performing the method of analyses as prescribed in the Brown & Root interoffice memorandum. The method calls for all analyses to start with the production of a filter cake and subsequent drying of the cake at 45-55°C. Because of the unique nature of the solids, the cakes were literally taking weeks to dry, and some did not dry at

TABLE 1

POND SLUDGE SAMPLES COLLECTED FOR MODIFIED GEOTECHNICAL ANALYSIS

Pond	Sample No.	Date Sampled
207A	PS-207A-SE	9-26-91
	PS-207A-~~E~~SW	9-26-91
	PS-207A-NE	9-26-91
	PS-207A-NW	9-26-91
207B-North	PS-207BN-NW	9-24-91
	PS-207BN-SW	9-24-91
	PS-207BN-SE	9-24-91
	PS-207BN-NE	9-24-91
207B-Center	PS-207BC-NW	9-25-91
	PS-207BC-NE	9-25-91
	PS-207BC-SE	9-25-91
	PS-207BC-SW	9-25-91
207B-South	PS-207BS-NW	9-25-91
	PS-207BS-NE	9-25-91
	PS-207BS-SE	9-25-91
	PS-207BS-SW	9-25-91
207C	PS-207C-NW	9-27-91
	PS-207C-NE	9-27-91
	PS-207C-SE	9-27-91
	PS-207C-SW	9-27-91

all. The end result was that the schedule of these analyses were severely delayed, and the productivity of the entire geotechnical lab was hindered. In response to this problem, a decision was made on January 9, 1992 to increase the oven temperature to 110°C to facilitate cake drying and eliminate the overwhelming backlog that had developed. However, the majority of pond sludge cake samples were dried at the lower temperature. One sample of Pond 207C sludge (PS-207C-NW) was dried at 50°C and at 110°C for the determination of moisture content. Both analyses were 29.5% solids, showing that the drying temperature had little effect on the solids determination.

To aid in the interpretation of the modified methods, a flow chart has been developed to show the origin of the various filter cakes and filtrates generated during performance of the modified methods (See Figure 1).

Analytical Data

The analytical data are presented in Tables 2 through 6. Grain size analysis curves are presented in Attachment 2. It should be noted that the decision to dry the solids before performing the grain size analysis resulted in interferences on certain samples. It is also apparent that drying the solids before grab size analysis has resulted in data that appears to overstate the weights of the coarser fractions. Previous wet sieve data and visual observations do not support the data generated by this method.

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Distribution:

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TABLE 2

GEOTECHNICAL DATA - MODIFIED METHOD

POND 207A

	NORTH WEST	SOUTH WEST	SOUTH EAST	NORTH EAST	
FILTERCAKE					
Specific Gravity	2.00	2.15	1.63	2.17	1.99
Specific Gravity (Salt Rinsed)	2.18	2.03	2.18	2.39	2.20
Viscosity (CP)	830[1]	1260[1]	660[1]	240	
Percent Water (Karl Fisher)	45.0	35.0	43.0	25.0	
Percent Solids (Filtercake)	23.5	15.9	22.0	44.0	
Grain Size (% passing sieve)					
Sieve 3/8 inch	100	100	100	100	
Sieve No. 4	98.1	97.4	98.4	98.4	
Sieve No. 10	77.9	74.5	80.8	92.7	
Sieve No. 20	44.2	53.6	48.1	67.3	
Sieve No. 50	19.8	33.4	16.7	24.4	
Sieve No. 100	8.1	19.6	8.2	8.9	
Sieve No. 200	2.2	8.2	2.8	2.2	
FILTRATE					
Specific Gravity (Hydrometer)	1.014	1.012	1.012	1.014	
Solids Dissolved (180°C), mg/L	14,000	13,000	13,000	16,000	
pH	8.3	8.3	8.3	8.2	
PYCNOMETER FILTRATE					
Specific Gravity (Hydrometer)	0.998	0.998	0.998	0.996	
Solids Dissolved (180°C), mg/L	2900	2000	3200	1500	
pH	7.5	7.4	7.9	8.1	
SALT RINSE FILTRATE					
Specific Gravity (Hydrometer)	0.998	0.998	1.000	0.998	
Solids Dissolved (180°C), mg/L	1600	3400	2300	860	
pH	7.6	10.6	7.4	7.8	

Source: Testing was performed at HALLIBURTON NUS Pittsburgh Laboratory as per Brown & Root's Guidelines for Data Testing.

(1) Viscosity determination done on a 1:1 ratio, solids:pond liquid

TABLE 3

GEOTECHNICAL DATA - MODIFIED METHOD

POND 207B NORTH

	NORTH WEST	SOUTH WEST	SOUTH EAST	NORTH EAST
FILTERCAKE				
Specific Gravity	2.50	2.48	2.53	2.44
Specific Gravity (Salt Rinsed)	2.46	2.43	2.46	2.43
Viscosity (CP)	860	620	690	1200
Percent Water (Karl Fisher)	34.0	42.0	39.0	38.0
Percent Solids (Filtercake)	25.3	27.5	25.3	26.8
Grain Size (% passing sieve)				
Sieve 3/8 inch	100	100	100	100
Sieve No. 4	98.5	97.4	98.5	97.6
Sieve No. 10	88.8	85.9	87.3	86.1
Sieve No. 20	57.7	59.2	57.7	61.1
Sieve No. 50	35.0	35.5	34.2	37.0
Sieve No. 100	18.2	26.9	16.8	22.0
Sieve No. 200	8.5	12.6	6.2	7.4
FILTRATE				
Specific Gravity (Hydrometer)	1.003	1.003	1.003	1.003
Solids Dissolved (180°C), mg/L	1900	1300	1600	1500
pH	8.0	8.2	7.9	7.8
PYCNOMETER FILTRATE				
Specific Gravity (Hydrometer)	0.996	0.996	0.996	0.996
Solids Dissolved (180°C), mg/L	540	580	650	680
pH	7.5	7.5	7.5	7.5
SALT RINSE FILTRATE				
Specific Gravity (Hydrometer)	0.996	0.994	0.994	0.996
Solids Dissolved (180°C), mg/L	340	580	460	460
pH	7.7	7.7	7.6	7.6

Source: Testing was performed at HALLIBURTON NUS Pittsburgh Laboratory as per Brown & Root's Guidelines for Engineering Data Testing.

TABLE 4

GEOTECHNICAL DATA - MODIFIED METHOD

POND 207B CENTER

	NORTH WEST	SOUTH WEST	SOUTH EAST	NORTH EAST
FILTERCAKE				
Specific Gravity	1.41	1.47	1.61	1.70
Specific Gravity (Salt Rinsed)	1.82	1.80	1.81	1.93
Viscosity (CP)	880(1)	1600(3)	1360(1)	1280(1)
Percent Water (Karl Fisher)	50.0	52.0	72.0	56.0
Percent Solids (Filtercake)	4.5	4.9	6.3	6.7
Grain Size (% passing sieve)				
Sieve 3/8 inch	INT(2)	INT(2)	INT(2)	INT(2)
Sieve No. 4	INT(2)	INT(2)	INT(2)	INT(2)
Sieve No. 10	INT(2)	INT(2)	INT(2)	INT(2)
Sieve No. 20	INT(2)	INT(2)	INT(2)	INT(2)
Sieve No. 50	INT(2)	INT(2)	INT(2)	INT(2)
Sieve No. 100	INT(2)	INT(2)	INT(2)	INT(2)
Sieve No. 200	INT(2)	INT(2)	INT(2)	INT(2)
FILTRATE				
Specific Gravity (Hydrometer)	1.011	1.015	1.015	1.015
Solids Dissolved (180°C), mg/L	20,000	20,000	21,000	21,000
pH	9.1	9.1	9.2	9.1
PYCNOMETER FILTRATE				
Specific Gravity (Hydrometer)	1.002	1.002	1.002	1.002
Solids Dissolved (180°C), mg/L	9100	11,000	8700	8200
pH	8.8	8.7	9.0	8.6
SALT RINSE FILTRATE				
Specific Gravity (Hydrometer)	1.000	1.001	1.007	1.002
Solids Dissolved (180°C), mg/L	7900	9000	13,000	7600
pH	9.2	8.9	8.7	8.3

Source: Testing was performed at HALLIBURTON NUS Pittsburgh Laboratory as per Brown & Root's Guidelines for Engineering Data Testing.

(1) Result at a 1:1.5 ratio, wet cake:pond liquid

(2) Interference- sample can't be broken up with a rubber tipped pestle. Sample dried into a hard, ceramic-like disk. To break the disk up with a harder pestle would crush the individual particles.

(3) Result at a 1:2 ratio, wet cake:pond liquid

TABLE 5

GEOTECHNICAL DATA - MODIFIED METHOD

POND 207B SOUTH

	NORTH WEST	SOUTH WEST	SOUTH EAST	NORTH EAST
FILTERCAKE				
Specific Gravity	1.78	2.17	1.93	1.90
Specific Gravity (Salt Rinsed)	1.85	1.98	1.99	2.08
Viscosity (CP)	1430(1)	1570(3)	770(1)	1650(3)
Percent Water (Karl Fisher)	70.0	62.0	56.0	64.0
Percent Solids (Filtercake)	6.3	14.5	9.6	10.1
Grain Size (% passing sieve)				
Sieve 3/8 inch	INT(2)	90.8	100	100
Sieve No. 4	INT(2)	48.0	80.7	84.3
Sieve No. 10	INT(2)	25.1	51.5	55.8
Sieve No. 20	INT(2)	15.2	33.2	35.8
Sieve No. 50	INT(2)	8.6	20.3	21.2
Sieve No. 100	INT(2)	5.8	14.4	15.3
Sieve No. 200	INT(2)	3.6	8.2	8.9
FILTRATE				
Specific Gravity (Hydrometer)	1.014	1.014	1.012	1.012
Solids Dissolved (180°C), mg/L	16,000	18,000	33,000	7000
pH	8.6	9.1	8.6	8.6
PYCNOMETER FILTRATE				
Specific Gravity (Hydrometer)	1.002	1.002	1.000	1.000
Solids Dissolved (180°C), mg/L	7900	5000	5000	4400
pH	8.8	9.2	9.5	9.6
SALT RINSE FILTRATE				
Specific Gravity (Hydrometer)	1.002	1.004	1.004	1.02(4)
Solids Dissolved (180°C), mg/L	5800	13,000	7600	19,000
pH	8.7	8.8	8.8	8.9

Source: Testing was performed at HALLIBURTON NUS Pittsburgh Laboratory as per Brown & Root's Guidelines for Engineering Data Testing.

(1) Result at a 1:1.5 ratio, wet cake:pond liquid

(2) Interference - sample can't be broken up with a rubber tipped pestle. Sample dried into a hard, ceramic-like disk. To break the disk up with a harder pestle would crush the individual particles.

(3) Result at a 1:1 ratio, wet cake:pond liquid

(4) Not sufficient quantity to be tested by hydrometer, done by pycnometer

TABLE 6

GEOTECHNICAL DATA - MODIFIED METHOD

POND 207C

	NORTH WEST	SOUTH WEST	SOUTH EAST	NORTH EAST	Ave.
<u>FILTERCAKE</u>					
Specific Gravity	2.92[1]	2.84	2.87	2.82	2.86
Specific Gravity (Salt Rinsed)	2.41	2.27	2.31	1.93	2.23
Viscosity (CP)	1660	600[2]	INT[3]	INT[3]	
Percent Water (Karl Fisher)	41.1	40.1	30.7	24.9	
Percent Solids (Filtercake)	29.5	33.7	40.8	56.1	
Grain Size (% passing sieve)					
Sieve 3/8 inch	100	100	100	100	
Sieve No. 4	94.9	97.5	98.4	95.1	
Sieve No. 10	58.6	71.6	76.3	67.2	
Sieve No. 20	32.9	42.5	48.8	39.7	
Sieve No. 50	14.6	19.9	23.9	17.2	
Sieve No. 100	7.9	10.7	13.4	10.0	
Sieve No. 200	3.5	4.2	5.7	4.1	
<u>FILTRATE</u>					
Specific Gravity (Hydrometer)	1.402	1.404	1.404	1.418	
Solids Dissolved (180°C), mg/L 45.45%	640,000	620,000	630,000	630,000	✓
pH	10.6	10.7	10.5	10.5	
<u>PYCNOMETER FILTRATE</u>					
Specific Gravity (Hydrometer)	1.062	1.067	1.077	1.082	
Solids Dissolved (180°C), mg/L	88,000	82,000	100,000	100,000	
pH	10.3	10.6	10.7	10.7	
<u>SALT RINSE FILTRATE</u>					
Specific Gravity (Hydrometer)	1.102	1.102	1.117	1.122	
Solids Dissolved (180°C), mg/L	130,000	120,000	150,000	160,000	
pH	10.1	10.5	10.6	10.6	

Source: Testing was performed at HALLIBURTON NUS Pittsburgh Laboratory as per Brown & Root's Guidelines for Data Testing.

(1) Dried at 110 degrees Celcius.

(2) Encountered some interference with crystal formation.

(3) Interference - unable to conduct test due to sample matrix, i.e...crystal formation.

FILE: 2K68\FIG1.DWG (03/20/92) KAC

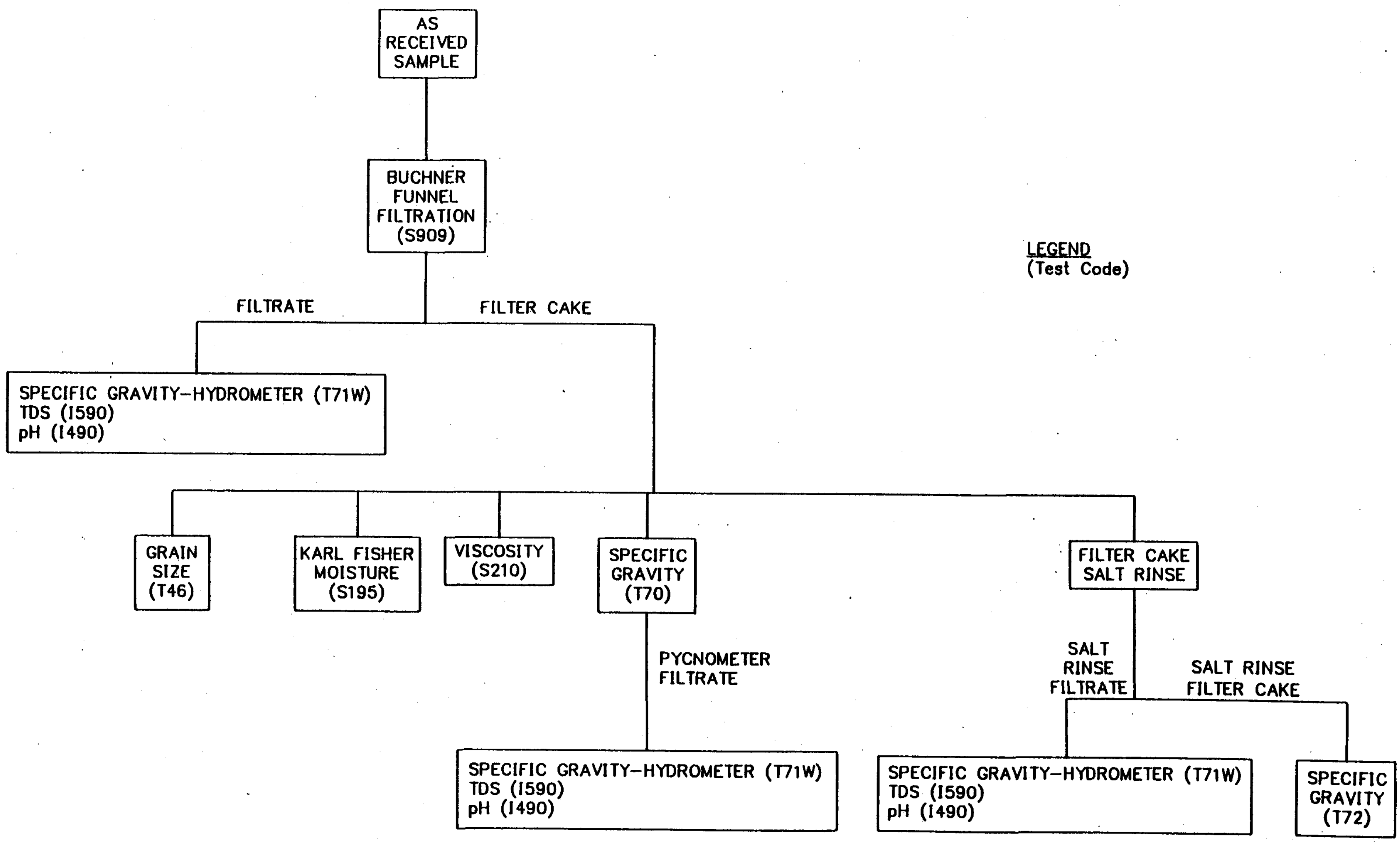


FIGURE 1

FLOW CHART OF MODIFIED GEOTECHNICAL METHODS
POND SLUDGE GEOTECHNICAL DATA
ROCKY FLATS PLANT, COLORADO

HALLIBURTON NUS Environmental Corporation

ATTACHMENT 1

TESTING GUIDELINES FOR ENGINEERING DATA

GUIDE LINES FOR ENGINEERING DATA TESTING

The engineering data required from the characterization testing include percent solids by gravimetric methods, percent hydrated water by Karl Fischer methods, specific gravity of the solids as-is and after dissolution of the precipitated salts, specific gravity, TDS, and pH of the pond solution entrained with the pond solids, a particle size analysis of the dried pond solids, and the slurry viscosity at 30 weight percent solids. In addition to these tests 100 grams of wet filtered pond solids shall be available for a viscosity determination at 30 wt% solids with pond water. Each sample shall be carefully prepared for the engineering test work, in order to not irreversibly change its physical character.

I. SAMPLE PREPARATION AND PERCENT SOLIDS DETERMINATION

The purpose of the Sample Preparation guidelines is to prepare each sludge sample for the engineering test work while not changing its character. In the Sample Preparation, the percent solids by gravimetric methods shall also be determined. It is absolutely essential that the excess water is removed from each sample by filtration prior to drying to prevent the dissolved solids in the liquid from being included with the solids present in the sludge and to prevent the dissolved salts from fusing the solids during drying.

Each quadrant sample will be handled separately as follows.

Weigh the entire sample by either weighing the sample bottle prior to emptying the sludge into a Buchner Funnel or by emptying the sludge into a tared bowl. Record the weight on the data sheet.

Remove the excess water by filtration using a Buchner Funnel and Erlenmeyer Flask. Pre-weigh the filter paper and record the weight on the data sheet. Do not wash the sample in any way with water. If sludge particles remain in the sample bottle and must be collected, use the filtrate from the Erlenmeyer Flask as rinse solution.

Measure the mass and the volume of the filtrate, making sure to include any filtrate used for rinsing, and record the information on the data sheet.

Take samples of the filtrate for specific gravity, TDS, and pH analyses. Store the remaining solution in a bottle labeled with the sample number, "sludge filtrate," and the date. A portion of this filtrate will be required for the viscosity measurement.

Remove the filter cake from the Buchner Funnel and transfer it to a stainless steel drying pan. If sludge particles remain on the sides of the Buchner Funnel, wet a second piece of filter paper with filtrate (do not use water) and use it to clean the particles from the funnel. If a second piece of filter paper is used, make sure its starting weight is recorded on the data sheet.

INTEROFFICE MEMORANDUM

DATE: September 17, 1991

FILE NO. 765.9

TO: W. C. Henderson WCH

FROM: J. H. Templeton JHT

SUBJECT: EG&G Rocky Flats
Solar Pond/Pondcrete Stabilization Project
B&R Job No. JR-1198

REFERENCE: Guidelines For Engineering Data Testing

Attached is the Guidelines Document outlining for the NUS lab in Pittsburgh exactly what tests we require and how we would like to see them performed.

Once you have reviewed the guidelines and agree with them, could you please initial next to your name, above, and I will send this memo and the guidelines to Richard Ninesteel at NUS.

Attachments:
- Guidelines For Engineering Data Testing
- Data Sheets For Engineering Data Testing
- ASTM method E203-75
- ASTM method D854-83
- ASTM method C136-84a

c: File

Brown&Root U.S.A., Inc.

Post Office Box 4574
Houston, TX 77210-4574

Letter No.: BAR-HEH-0063
File No.: 765.9

September 17, 1991

Halliburton NUS Environmental Corporation
9700 Richmond Avenue
Houston, Texas 77042

RECEIVED
SEP 17 1991
NUS CORP.

ATTENTION: Ted Bittner

SUBJECT: Rocky Flats Solar Pond/Pondcrete Stabilization Project
Brown & Root Job No. JR-1198

REFERENCE: Waste Characterization Tests at Pittsburgh Laboratory-Testing Guidelines For Engineering Data

Attached hereto are the testing guidelines for the required engineering data, data sheets for the testing, and the ASTM methods referenced in the guidelines.

We are sending a complete package to you and to Mr. Richard Ninesteel (NUS-PA), and copies without the ASTM procedures to the other personnel on the distribution list.

If you have any questions, please contact Jack Templeton at (713) 267-9551.

Very truly yours,

BROWN & ROOT, INC.

John R. Zak, P.E.
Project Manager

Attachments:
- Guidelines For Engineering Data Testing
- Data Sheets For Engineering Data Testing
- ASTM method E203-75
- ASTM method D854-83
- ASTM method C136-84a

JRZ/jt

c: R. Ninesteel/A. Allen/DRB/WCH/JHT/File

Measure the wet weight of the filter cake, including any filter paper used. Record the wet weight of the filter cake, and the dry weight of any filter paper used on the data sheet.

Take a split of the wet filter cake by cutting a pie-section using a laboratory scraper. The size of this pie-section is dependent solely on the amount of material required for a Karl Fischer analysis, plus an additional 100 grams for the viscosity test.

Reweigh the wet filter cake, weigh the splits for Karl Fischer and viscosity analyses, and record the weights on the data sheet.

The Karl Fischer Analyses should be run as described in ASTM method E203-75, using the appropriate solutions to prevent interferences from contained ions. If the filtered solids contain so much water that the method becomes questionable, then perform the Karl Fischer analysis on the dried filter cake. When the method is run on the wet cake, the result will yield the combined free and hydrated water, when run on the dry cake (dried at 45-55°C) the result will only be the hydrated water. Both values are useable from an engineering standpoint as long as the percent solids by gravimetric methods is determined as outlined in this document, and it is indicated on the data sheet if the cake is moist or dry.

increased to 110°F

The filtered sample and all filter paper used should be dried in an oven set at 45-55°C for a minimum of 24 hours.

At the end of 24 hours the sample should be cooled in a desiccator and weighed. The sample should be returned to the oven and dried for an additional 12 hours. If the weight change is greater than 1%, continue to dry the sample in 12 hour increments. When dry, record the dry weight of the sample on the data sheet.

Carefully scrape any dried sludge particles from the dried filter paper. Weigh the filter paper and record the weight on the data sheet. Break up any agglomerated pieces of sludge formed during drying using a laboratory scraper or a pestle.

Blend the dried sample by rolling on a heavy gauge plastic or rubber sheet and take the following splits by cutting representative sections from the rolled sludge. (If you are unfamiliar with the rolling technique, please call Jack Templeton (713) 267-9551). These weights are approximate, it is only important to record the actual weight used.

50g for specific gravity as is
50g for specific gravity after salt dissolution
500g for particle size analysis

Place the remaining sample in a container labeled with the sample number, "Excess Sludge Dried at 45-55°C," and the date.

II. SPECIFIC GRAVITY OF DRIED SOLIDS

The purpose of the following test work is to determine a) the as-is specific gravity of the dried pond sludge, and b) the specific gravity of the pond sludge with all the soluble salts removed.

a) Determination of the as-is specific gravity of the dried pond sludge

Take one 50g split of the dried pond sludge and determine the specific gravity using ASTM method D854-83.

After following ASTM method D854-83, empty the pycnometer into a Buchner Funnel and remove the solution by filtration. Determine the filtrate specific gravity, TDS and pH. Transfer the filter cake to a preweighed stainless steel drying pan, determine the total weight of the wet solids, and dry at 45-55°C as in Section I.

Record all weights on the data sheet.

b) Determination of the specific gravity of the pond sludge with all the soluble salts removed

Transfer the other 50g split to a 500ml beaker and add 250ml of deionized water. Stir for 2 hours and filter in a Buchner Funnel. Do not wash the filtered solids.

Measure the weight and volume of the filtrate and use the determine the filtrate specific gravity, TDS and pH. Record this information on the data sheet.

Place the washed filter cake in a preweighed stainless steel drying pan, weigh and dry at 45-55°C as in Section I.

When dry, weigh the dry, washed solids and determine the specific gravity using ASTM method D854-83.

Make sure all of the requested data is recorded on the data sheet.

III. PARTICLE SIZE ANALYSIS

The purpose of the following is to yield the weight of the dried pond solids at various size fractions. The entire screen analysis should be performed dry to prevent the dissolution of any soluble salts. The starting material for this test must be pond sludge which has been dewatered prior to drying, and dried at a moderate temperature (45-55°C) to prevent fusion of the solids by the dissolved salts. The process group of Brown and Root recognizes that some dissolved salts will be present with the dried pond sludge, due to being unable to wash the solids. However this inaccuracy cannot be avoided and the error can be identified at less than 5%.

ASTM method C136-84a of coarse and fine aggregates is a good approximation of the method we should like followed. The applicable points being that it is performed on dry solids, and that the bottom size is a #200 screen.

Use the following U.S. Standard screen sizes, to make the results directly comparable to the previous Weston data.

3"	75.0 mm	#10	2.00 mm
1.5"	37.5 mm	#20	0.85 mm
0.75"	19.0 mm	#50	0.30 mm
0.375"	9.5 mm	#100	0.15 mm
#4	4.75 mm	#200	0.075 mm

The split for the particle size analysis should have been retained in a desiccator to avoid reabsorption of moisture from the air.

Measure and record on the data sheet the starting weight of the sample to be sieved.

The sieving can be done using a mechanical shaker, if available, or by hand.

Follow the procedure outlined in steps 7.2, 7.3, and 7.4 (ASTM C136-84a). Under no conditions shall any portion of step 7.5 be used. If hand sieving, start at the coarsest screen size and work down to the finest.

When the material on the screen passes the 1% criteria outlined in 7.4, visually inspect it to ensure the oversize product contains no agglomerates formed during drying. If agglomerates are present break them apart between a thumb and finger, minimizing any grinding action, and rescreen that size fraction and the resulting undersize on those size fractions finer.

Measure and record on the data sheet the weight of each size fraction including the +75 mm, and the -0.075 mm.

IV. VISCOSITY DETERMINATION

The viscosity of each pond sludge should be determined at 30 weight percent solids. Whatever method the lab has available to perform the test should be reviewed by the B&R Process Group prior to implementation, to ensure that it is applicable for the particle size and the processing conditions we anticipate using.

Take the weight of the ~100g of wet filter cake split out for the viscosity analysis, and the percent solids value in the wet cake determined gravimetrically and calculate the dry solids and liquid present.

Calculate total weight of pond liquid required to produce a 30 weight percent solids slurry. Subtract from this weight the weight of the liquid present in the wet cake, and add the difference from the stored filtrate.

Record the weight and volume of the filtrate added on the data sheet.

Run the viscosity test.

ENGINEERING DATA TESTING
DATA SHEET

I. SAMPLE PREPARATION

SAMPLE NUMBER: ____________
TEST START DATE: ____________
RESPONSIBLE TECHNICIAN SIGNATURE: ____________

1. TOTAL SLUDGE SAMPLE MASS (AS-IS)
   PAN TARE MASS ____________ grams
   PAN + WET SLUDGE ____________ grams
   TOTAL WET SLUDGE MASS ____________ grams

2. FILTER PAPER MASS ____________ grams

3. FILTRATE MASS ____________ grams
   FILTRATE VOLUME ____________ grams

4. FILTRATE SPECIFIC GRAV. ____________ grams
   FILTRATE TDS ____________ ppm
   FILTRATE pH ____________
   EXCESS FILTRATE LABELED ____________ -SLUDGE FILTRATE-

5. FILTER PAPER MASS ____________ grams
   (used to clean out Buchner Funnel)

6. FILTER CAKE TOTAL MASS
   PAN TARE MASS ____________ grams
   PAN + WET FILTER CAKE ____________ grams
   FILTER CAKE MASS ____________ grams

7. MASS OF EACH FILTER CAKE SPLIT
   KARL FISCHER (wet) ____________ grams
   VISCOSITY (wet) ____________ grams

8. KARL FISCHER ANALYSIS
   PERFORMED ON (WET/DRY) FILTER CAKE ____________

9. DRYING OVEN TEMPERATURE ____________ °C

10. DRY SOLIDS (FILTER CAKE) MASS
    AFTER 24 HOURS ____________ grams
    AFTER 36 HOURS ____________ grams ______ % change
    AFTER 48 HOURS ____________ grams ______ % change
    AFTER 60 HOURS ____________ grams ______ % change

    DRY SOLIDS MASS ____________ grams

11. DRIED FILTER PAPER MASS ____________ grams (in Buchner Funnel)
    DRIED FILTER PAPER MASS ____________ grams (to clean Buchner)
    ANY AGGLOMERATED SOLIDS? ____________

ENGINEERING DATA TESTING
DATA SHEET

I. Sample Preparation (continued)

12. MASS OF DRIED SOLIDS SPLIT
    SPECIFIC GRAVITY (AS-IS) ________ grams
    SPECIFIC GRAVITY (DISS) ________ grams
    PARTICLE SIZE ANALYSIS ________ grams

13. EXCESS DRIED SOLIDS LABELED
    -EXCESS SLUDGE DRIED AT 45-55°C-

ENGINEERING DATA TESTING
DATA SHEET

II. SPECIFIC GRAVITY OF DRIED SOLIDS

SAMPLE NUMBER: ____________________
TEST START DATE: ____________________
RESPONSIBLE TECHNICIAN SIGNATURE: ____________________

a) Determination Of The As-Is Specific Gravity

1. STARTING MASS OF SOLIDS ____________ grams
   SPECIFIC GRAVITY
   (per ASTM D854-83) ____________

2. AS-IS SOLIDS S.G. FILTRATE
   MASS ____________ grams
   VOLUME ____________ ml
   SPECIFIC GRAVITY ____________
   TDS ____________ ppm
   pH ____________

3. AS-IS SOLIDS S.G. FILTER CAKE
   PAN TARE MASS ____________ grams
   PAN + WET CAKE ____________ grams
   WET CAKE MASS ____________ grams
   DRYING OVEN TEMPERATURE ____________ °C
   PAN + DRY CAKE ____________ grams
   DRY CAKE MASS ____________ grams

b) Determination Of The Specific Gravity Of The Dried Solids After Soluble Salt Dissolution

1. STARTING MASS OF SOLIDS ____________ grams
   VOLUME OF D.I. WATER ____________ ml

2. SALT DISSOLUTION FILTRATE
   MASS ____________ grams
   VOLUME ____________ ml
   SPECIFIC GRAVITY ____________
   TDS ____________ ppm
   pH ____________

3. SALT DISSOLUTION FILTER CAKE
   PAN TARE MASS ____________ grams
   PAN + WET CAKE ____________ grams
   WET CAKE MASS ____________ grams
   DRYING OVEN TEMPERATURE ____________ °C
   PAN + DRY CAKE ____________ grams
   DRY CAKE MASS ____________ grams

4. SPECIFIC GRAVITY OF INSOLUBLE SOLIDS
   (per ASTM D854-83) ____________

ENGINEERING DATA TESTING
DATA SHEET

III. PARTICLE SIZE ANALYSIS

SAMPLE NUMBER: ____________________
TEST START DATE: ____________________
RESPONSIBLE TECHNICIAN SIGNATURE: ____________________

1. MASS OF PARTICLE SIZE ANALYSIS SAMPLE __________ grams
2. SHAKING METHOD (MECHANICAL/HAND) __________
3. ANY AGGLOMERATED SOLIDS? __________
4. SCREEN ANALYSIS

SIZE FRACTION	DRY WEIGHT	WEIGHT DISTRIBUTION
+75 mm	______ g	______ %
-75 +37.5 mm	______ g	______ %
-37.5 +19.0 mm	______ g	______ %
-19.0 +9.5 mm	______ g	______ %
-9.5 +4.75 mm	______ g	______ %
-4.75 +2.0 mm	______ g	______ %
-2.0 +0.85 mm	______ g	______ %
-0.85 +0.30 mm	______ g	______ %
-0.30 +0.15 mm	______ g	______ %
-0.15 +0.075 mm	______ g	______ %
-0.075 mm	______ g	______ %
TOTAL	______ g	______ %

IV. VISCOSITY DETERMINATION

SAMPLE NUMBER: ____________________
TEST START DATE: ____________________
RESPONSIBLE TECHNICIAN SIGNATURE: ____________________

1. MASS OF WET CAKE FOR VISCOSITY DETERMINATION __________ g
   PERCENT SOLIDS (by wt.) IN WET CAKE __________ %

   CONTAINED DRY SOLIDS IN WET CAKE __________ g
   CONTAINED LIQUID IN WET CAKE __________ g

2. REQUIRED QUANTITY OF POND LIQUID REQUIRED
   FOR A 30 WT% SOLIDS SLURRY __________ g
   OF ADDITIONAL POND LIQUID __________ g

3. MASS OF POND LIQUID ADDED __________ g

4. VISCOSITY OF 30% SOLIDS SLURRY __________ cp

   VISCOSITY TEST CONDITIONS ____________________
   ____
   ____

ATTACHMENT 2

GRAIN SIZE ANALYSIS CURVES

NUS CORPORATION

Laboratory No. P175763

Sheet ______ of ______

Project Name Rocky Flats Project No. ______ Tested by DN/MDS date 1-7-92

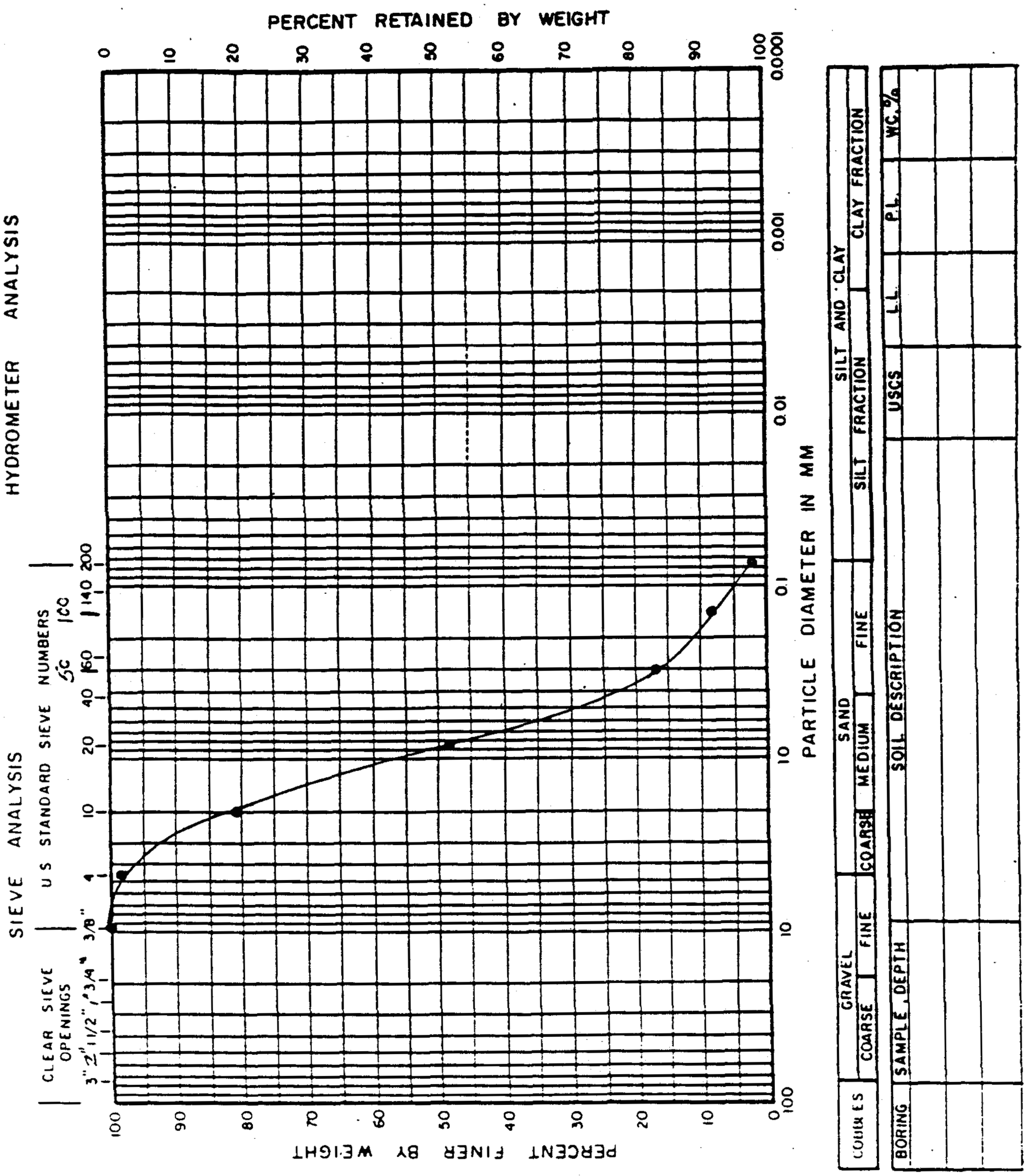
Boring/Test Pit No. ______ Sample No. ______ Calculated by DN date 2-24-9

Sample Depth ______ Sample Type ______ Checked by JCL date 25 Feb 92

Sample Description PS-207A-SE

Sample Preparation Method ______

GRAIN SIZE ANALYSIS
COHESIVE MATERIAL



063-92
05

NUS CORPORATION

Laboratory No. P175769

Sheet ______ of ______

Project Name Rocky Flats Project No. ______ Tested by DN/MOS date 2-17-

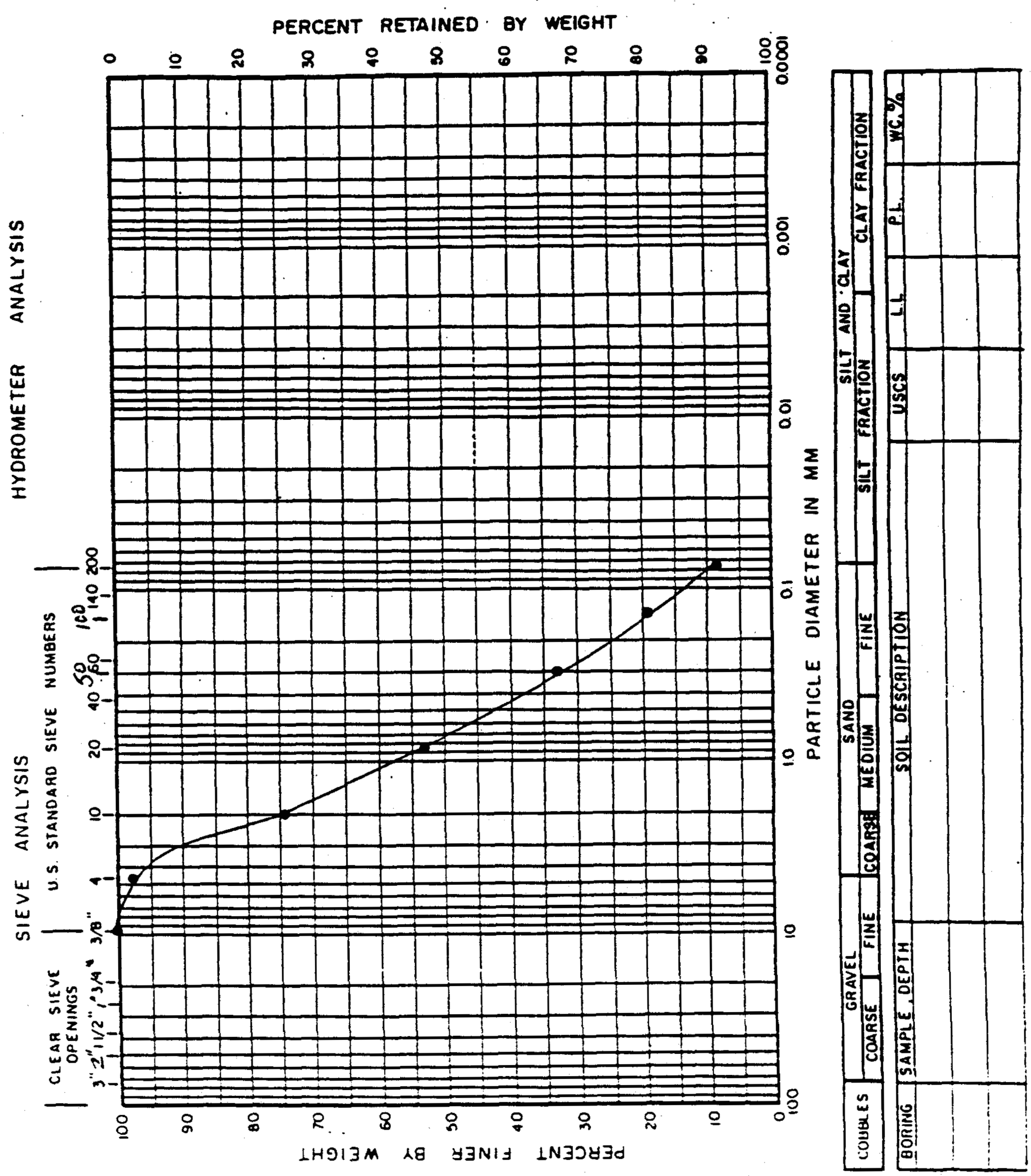
Boring/Test Pit No. ______ Sample No. ______ Calculated by DN date 2-25-

Sample Depth ______ Sample Type ______ Checked by JCC date 26 Feb

Sample Description PS-207A-SW

Sample Preparation Method ______

GRAIN SIZE ANALYSIS
COHESIVE MATERIAL



063-92
30

NUS CORPORATION

Laboratory No. P175765

Sheet ______ of ______

Project Name Rocky Flats Project No. ______ Tested by DN/MDS date 1-7-9

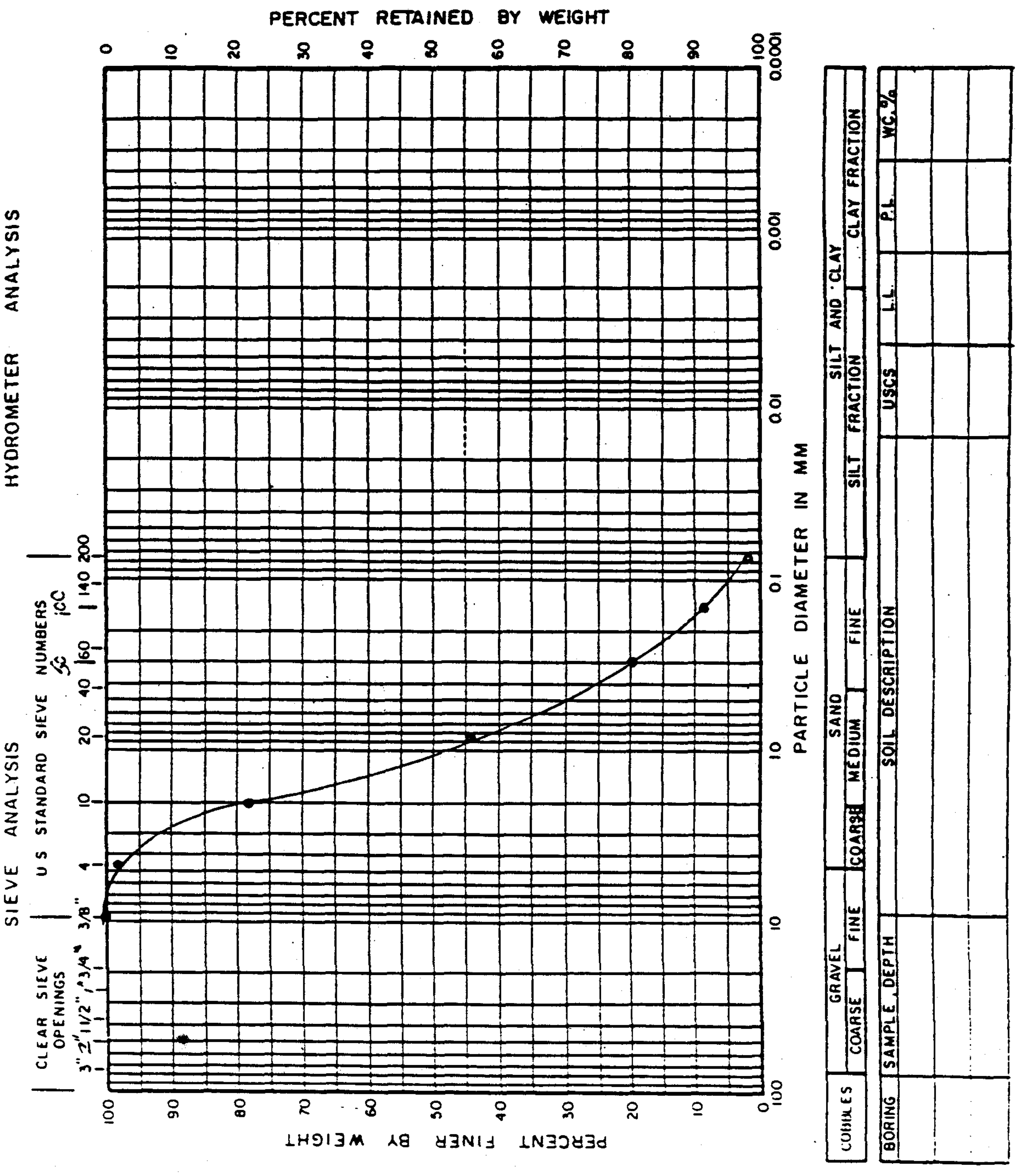
Boring/Test Pit No. ______ Sample No. ______ Calculated by DN date 2-24-9

Sample Depth ______ Sample Type ______ Checked by JCL date 25Feb9

Sample Description PS-207A-NW

Sample Preparation Method ______

GRAIN SIZE ANALYSIS
COHESIVE MATERIAL



063-92
06

NUS CORPORATION

Laboratory No. P175766

Sheet ______ of ______

Project Name Rocky Flats Project No. ______ Tested by DN/mos date 1-7-92

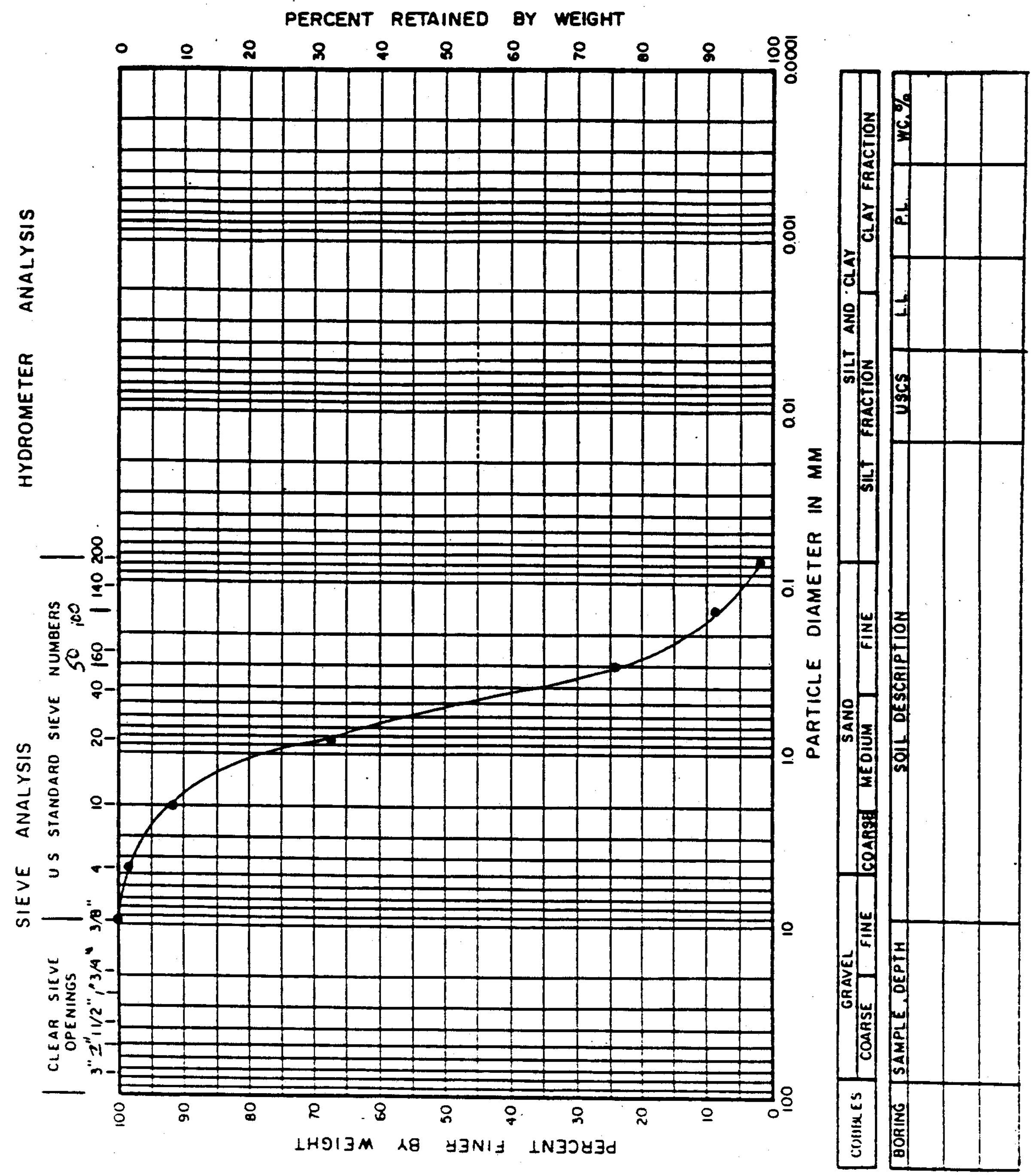
Boring/Test Pit No. ______ Sample No. ______ Calculated by DN date 2-24-92

Sample Depth ______ Sample Type ______ Checked by JCL date 25 Feb 92

Sample Description PS-207A-NE

Sample Preparation Method ______

GRAIN SIZE ANALYSIS
COHESIVE MATERIAL



063-92
07

NUS CORPORATION

Laboratory No. P175754

Sheet ______ of ______

Project Name Rocky Flats Project No. ______ Tested by DJ/MDS date 1-7-92

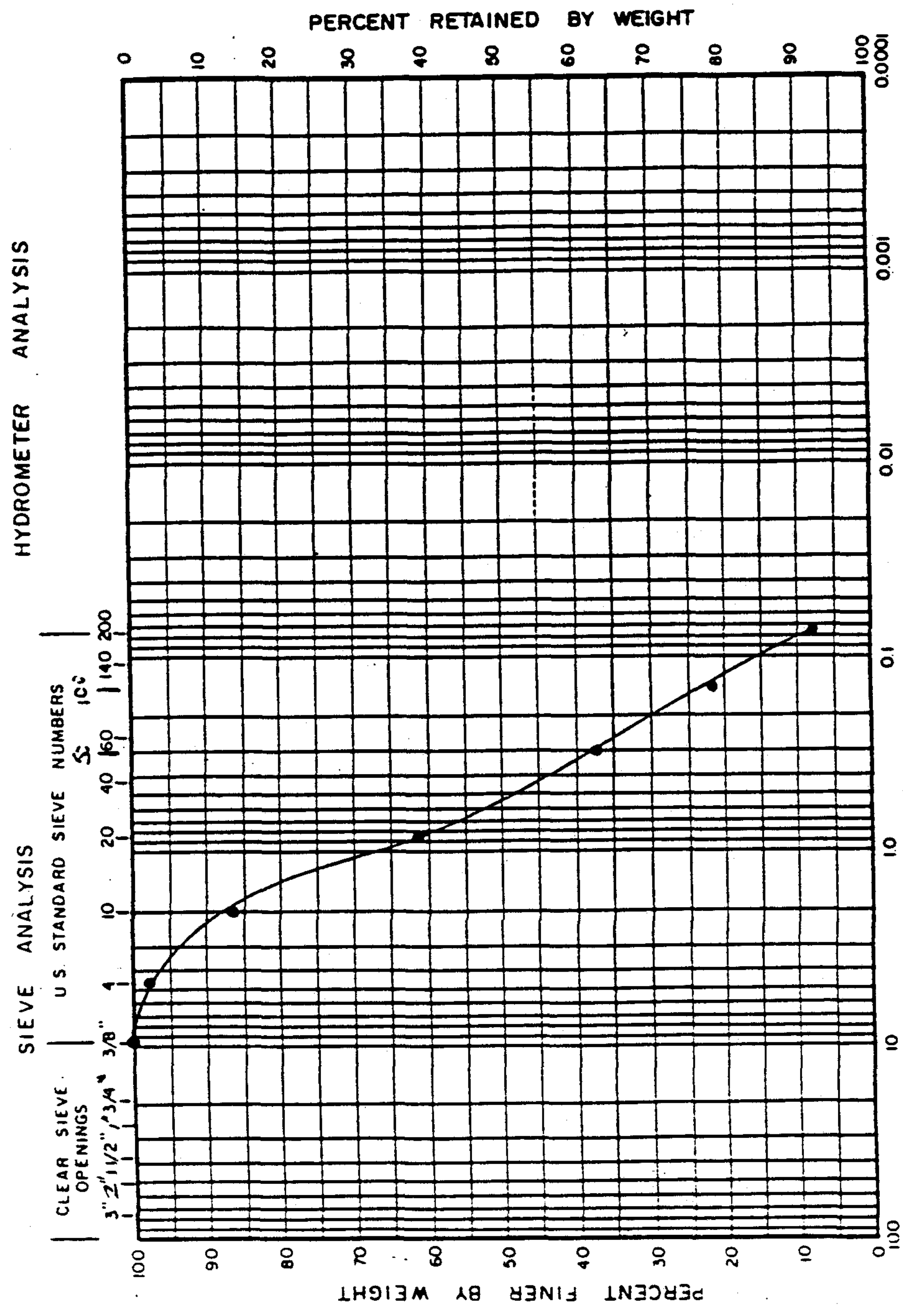
Boring/Test Pit No. ______ Sample No. ______ Calculated by DJ date 2-24-92

Sample Depth ______ Sample Type ______ Checked by JCL date 25 Feb 92

Sample Description PS-207BN-NE

Sample Preparation Method ______

GRAIN SIZE ANALYSIS
COHESIVE MATERIAL



COBBLES	GRAVEL COARSE	GRAVEL FINE	SAND COARSE	SAND MEDIUM	SAND FINE	SILT AND CLAY: SILT FRACTION	SILT AND CLAY: CLAY FRACTION

BORING	SAMPLE DEPTH	SOIL DESCRIPTION	USCS	L.L.	P.L.	W.C.%

063-92
(04)

NUS CORPORATION

Laboratory No. P175751

Sheet ____ of ____

Project Name Rocky FlATS Project No. ____ Tested by DN/mos date 1-7-92

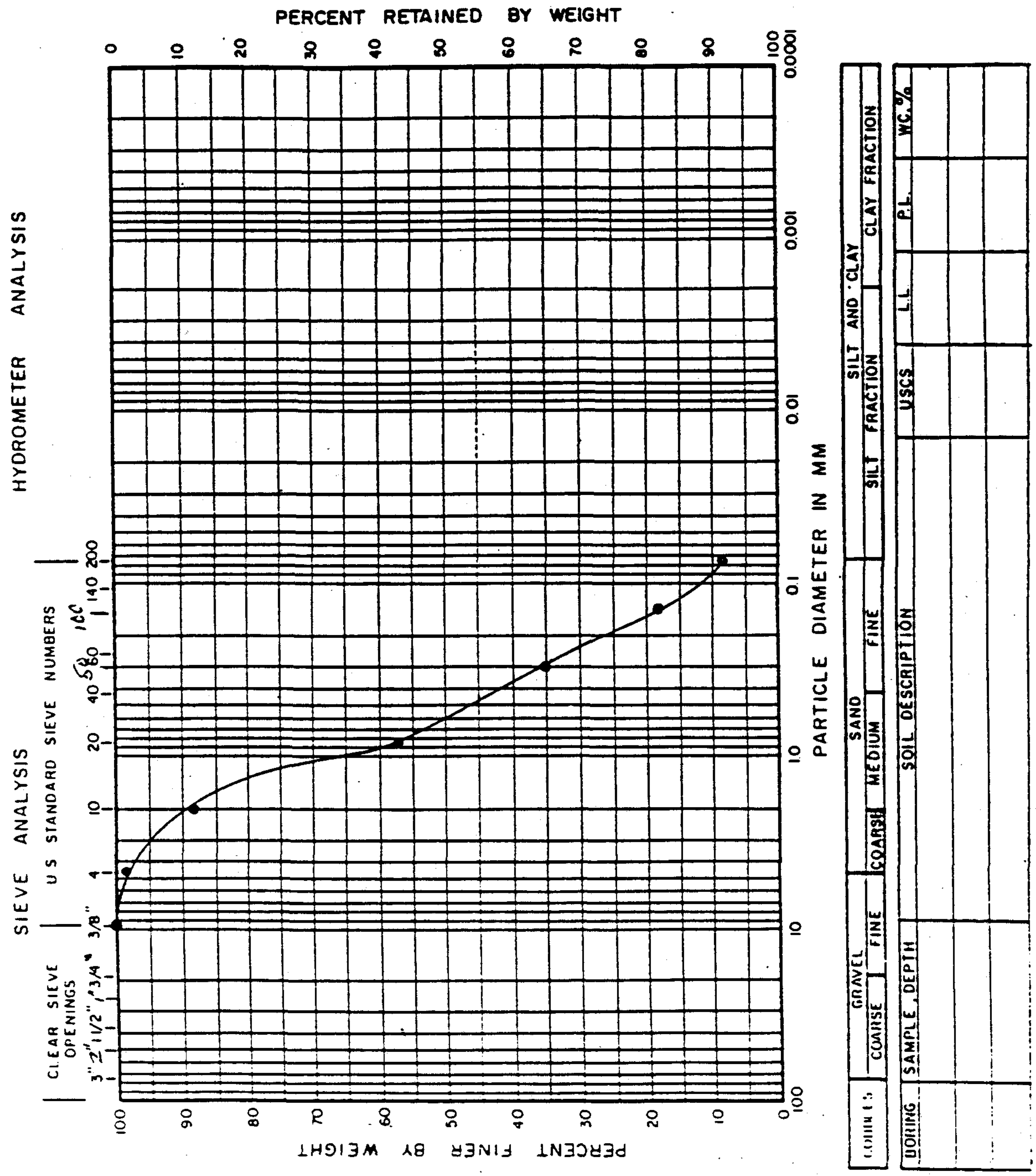
Boring/Test Pit No. ____ Sample No. ____ Calculated by DN date 2-24-92

Sample Depth ____ Sample Type ____ Checked by JCL date 25FEB92

Sample Description PS-207BN-NW

Sample Preparation Method ____

GRAIN SIZE ANALYSIS
COHESIVE MATERIAL



063-92
01

NUS CORPORATION

Laboratory No. P175252

Sheet ______ of ______

Project Name Rocky Flats Project No. ______ Tested by DN/MDS date 1-7-92

Boring/Test Pit No. ______ Sample No. ______ Calculated by DN date 2-24-92

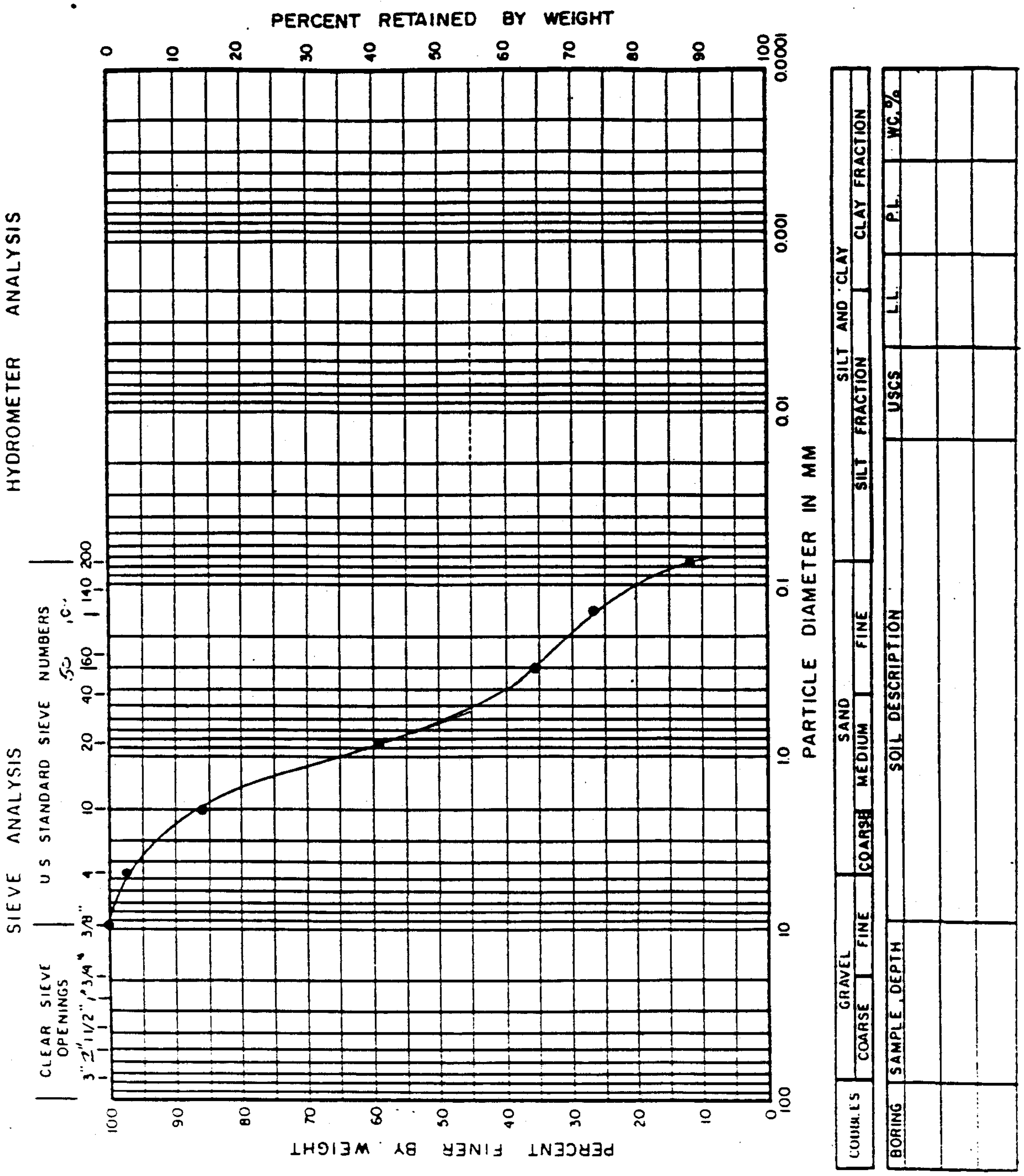
Sample Depth ______ Sample Type ______ Checked by JCL date 25 Feb 92

Sample Description PS-207BN-SW

Sample Preparation Method ______

GRAIN SIZE ANALYSIS

COHESIVE MATERIAL



063-92

02

NUS CORPORATION

Laboratory No. P175753

Sheet ______ of ______

Project Name Rocky Flats Project No. ______ Tested by DN/MDS date 1-2-92

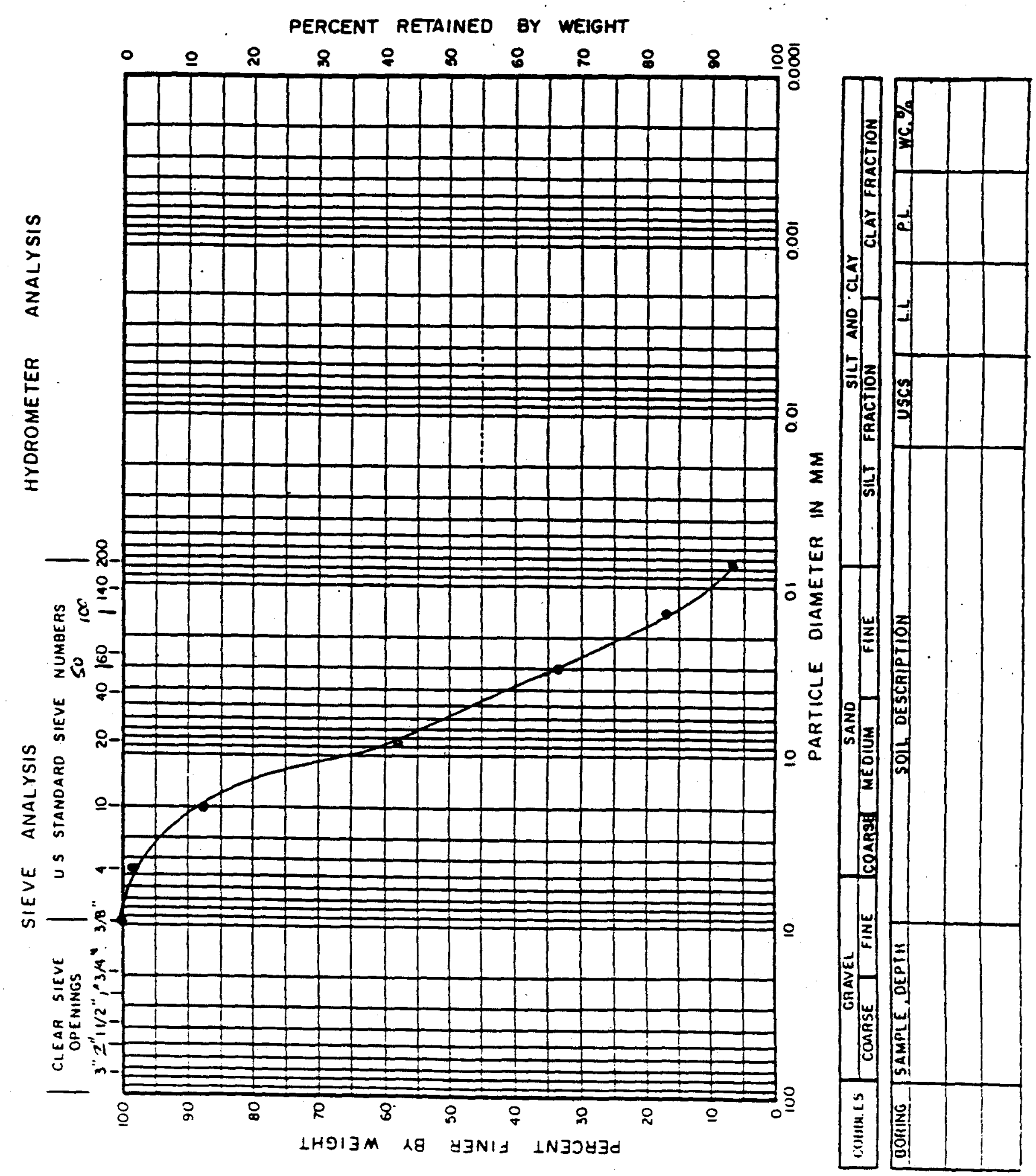
Boring/Test Pit No. ______ Sample No. ______ Calculated by DN date 2-24-92

Sample Depth ______ Sample Type ______ Checked by JCL date 25FEB92

Sample Description PS-207BN-SE

Sample Preparation Method ______

GRAIN SIZE ANALYSIS
COHESIVE MATERIAL



063-92
03

NUS CORPORATION

Laboratory No. 175760

Sheet ______ of ______

Project Name Rocky Flats Project No. ______ Tested by DN/MOS date 2-8-92

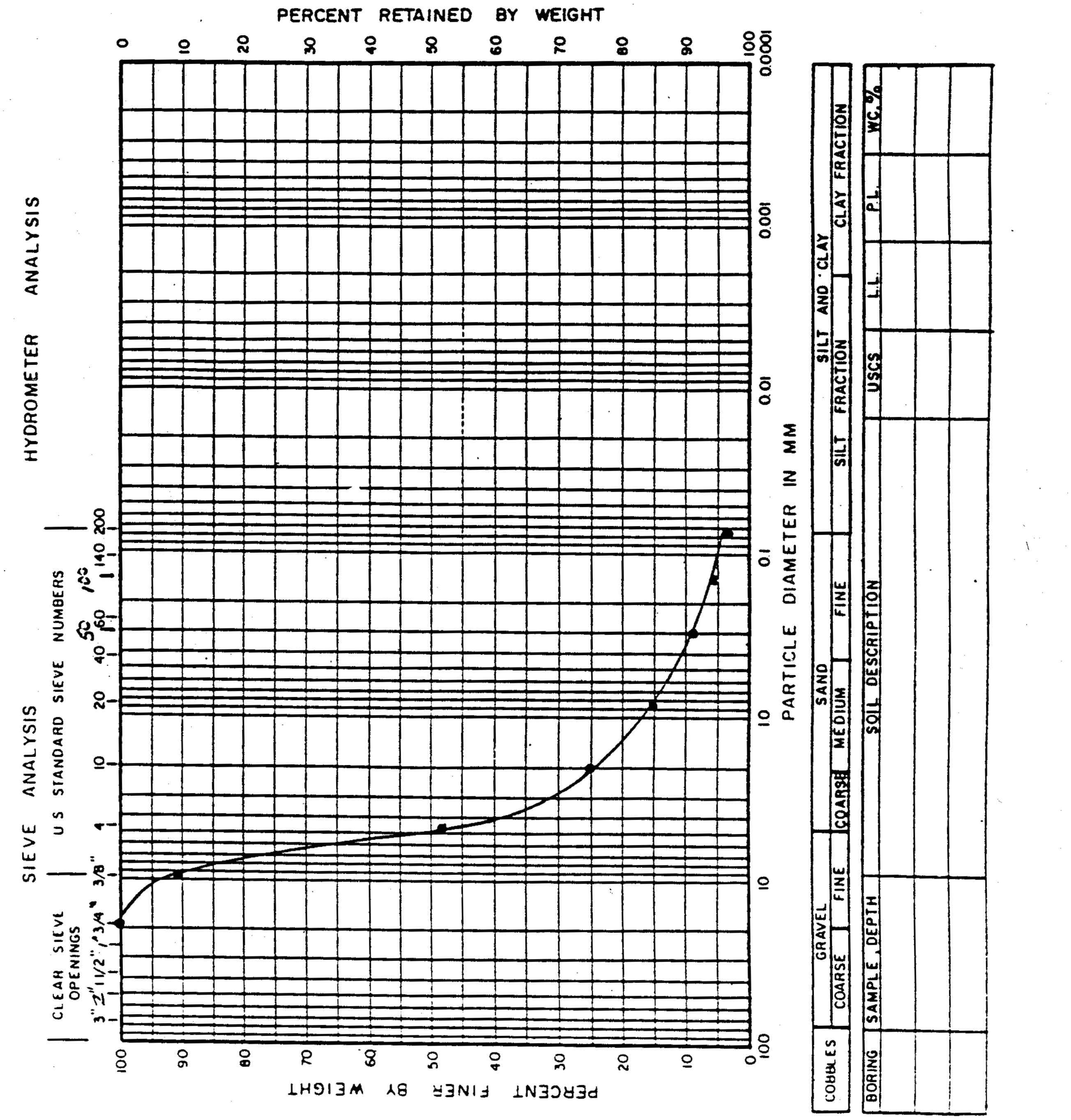
Boring/Test Pit No. ______ Sample No. ______ Calculated by DN date 2-25-92

Sample Depth ______ Sample Type ______ Checked by JCL date 25Feb92

Sample Description PS-207BS-NW SW

Sample Preparation Method ______

GRAIN SIZE ANALYSIS
COHESIVE MATERIAL



063-92
(19)

NUS CORPORATION

Laboratory No. P175761

Sheet ______ of ______

Project Name Rocky Flats Project No. ________ Tested by DN/MDS date 2-8-92

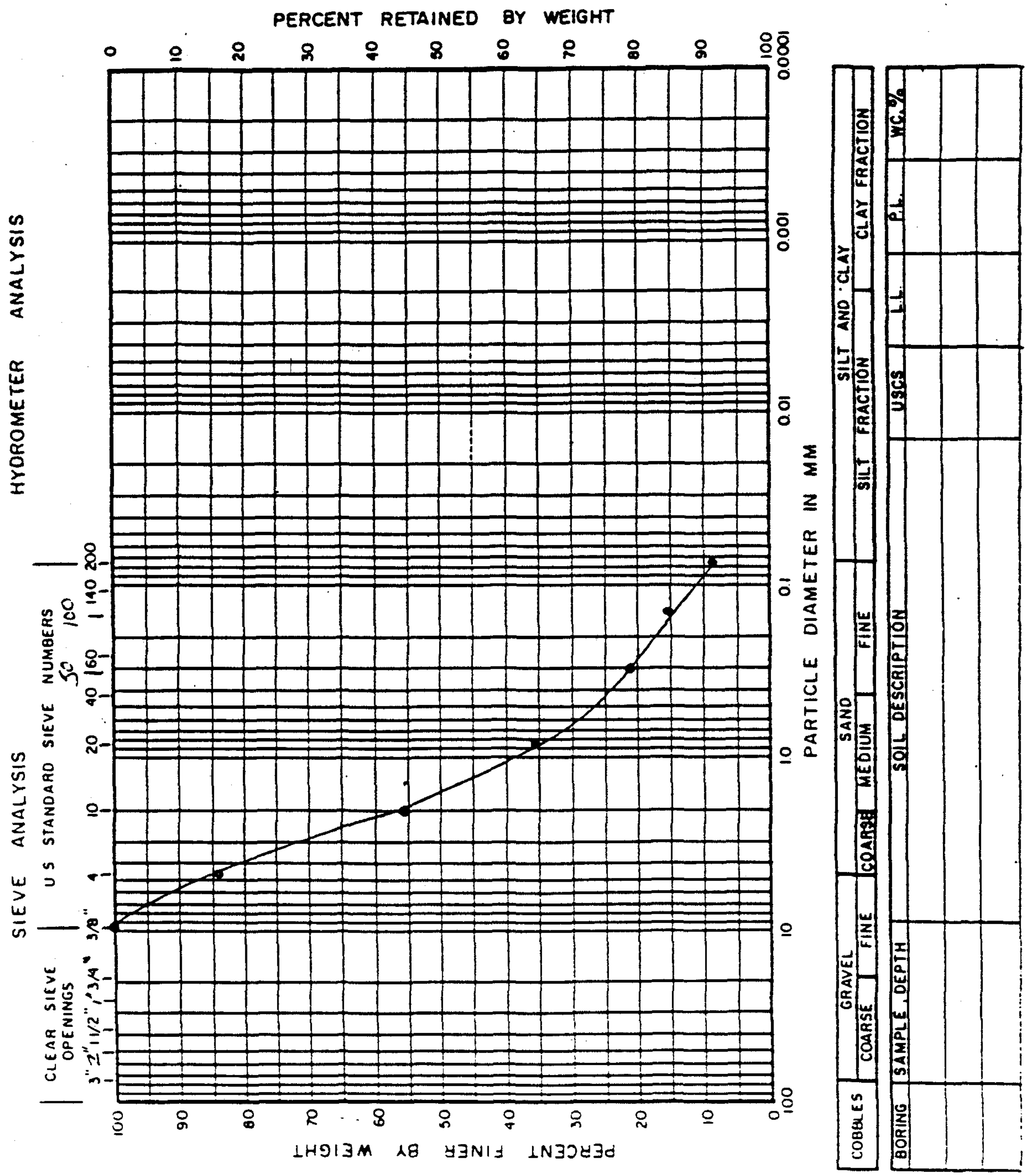
Boring/Test Pit No. ________ Sample No. ________ Calculated by DN date 2-24-9

Sample Depth ________ Sample Type ________ Checked by JL date 25 Feb 9

Sample Description PS-207BS-~~NW~~ ON NE

Sample Preparation Method ________

GRAIN SIZE ANALYSIS
COHESIVE MATERIAL



063-92

C8

NUS CORPORATION

Laboratory No. P175762

Sheet ______ of ______

Project Name Rocky Flats Project No. ______ Tested by DW/MDS date 2-8-92

Boring/Test Pit No. ______ Sample No. ______ Calculated by DW date 2-24-92

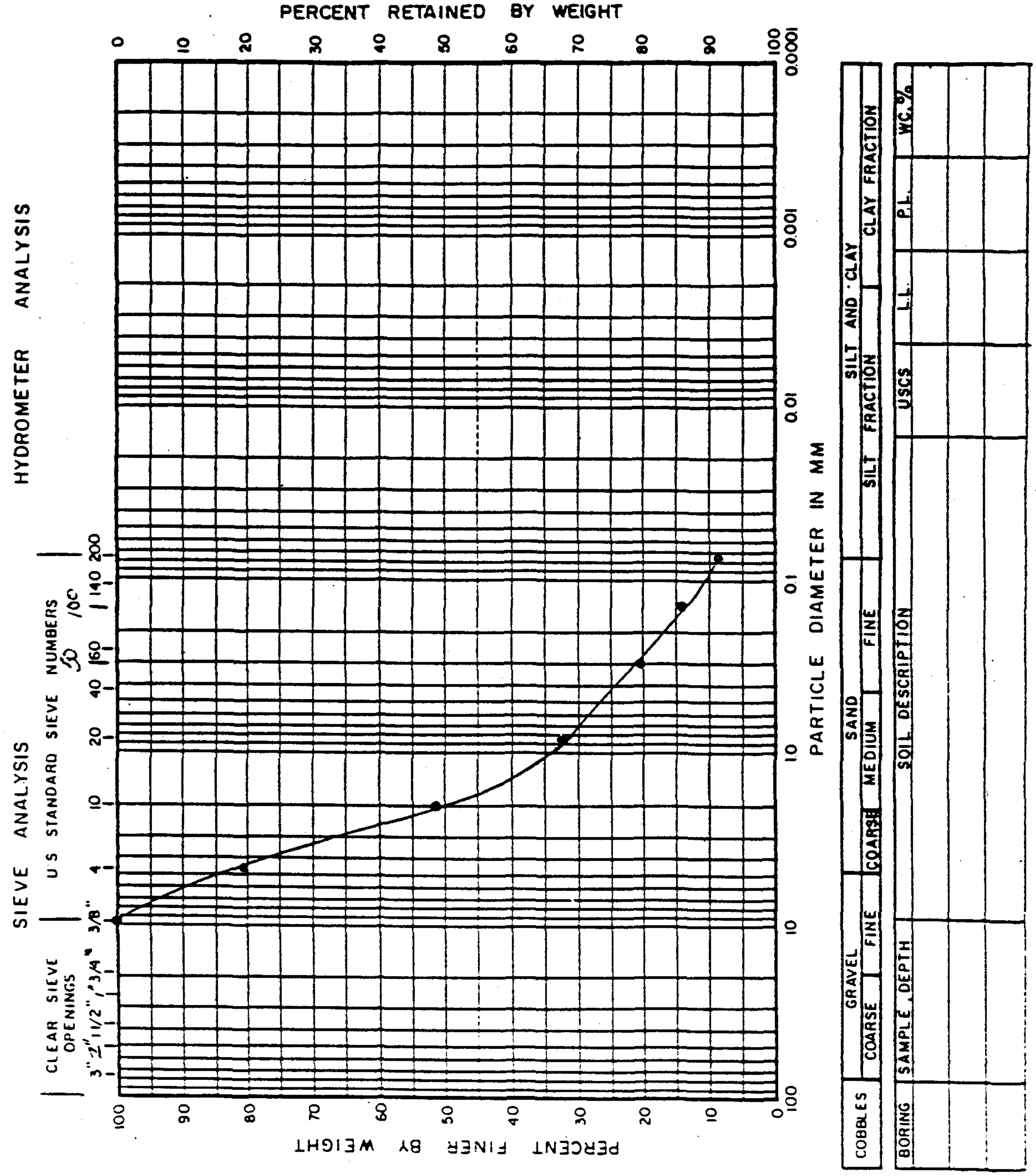
Sample Depth ______ Sample Type ______ Checked by JL date 25Feb92

Sample Description PS-207BS-3E

Sample Preparation Method ______

GRAIN SIZE ANALYSIS

COHESIVE MATERIAL



063-92

(69)

NUS CORPORATION

Laboratory No. P175767

Sheet ______ of ______

Project Name Rocky Flats Project No. ______ Tested by DN/MDS date 2-16-9

Boring/Test Pit No. ______ Sample No. ______ Calculated by DN date 2-25-9

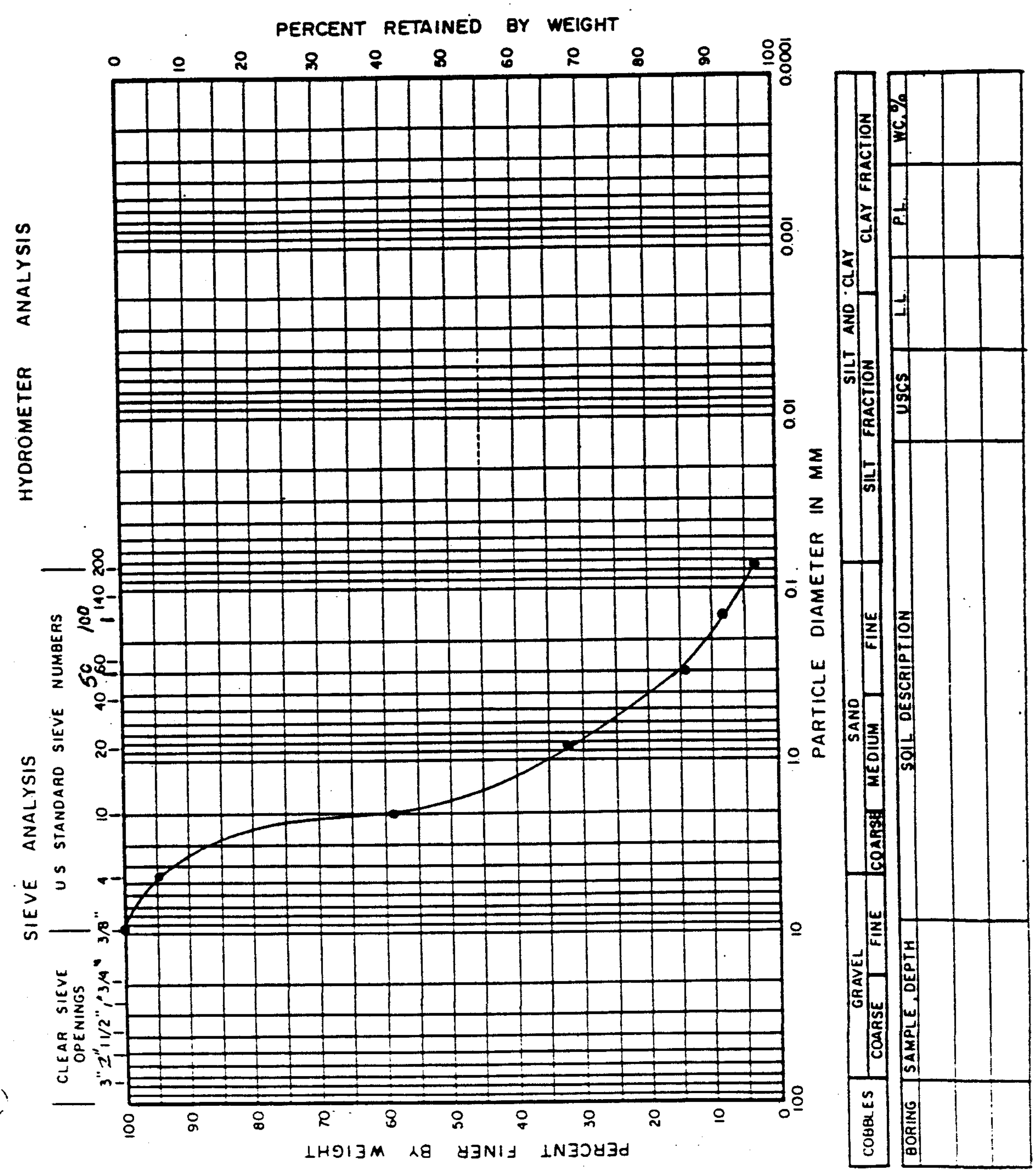
Sample Depth ______ Sample Type ______ Checked by JCL date 26 Feb 9

Sample Description PS-207C-NW

Sample Preparation Method ______

GRAIN SIZE ANALYSIS

COHESIVE MATERIAL



06392

65 (21)

NUS CORPORATION

Laboratory No. P175769

Sheet ______ of ______

Project Name Rocky Flats Project No. ______ Tested by DN/MDS date 2-16-9

Boring/Test Pit No. ______ Sample No. ______ Calculated by DN date 2-25-9

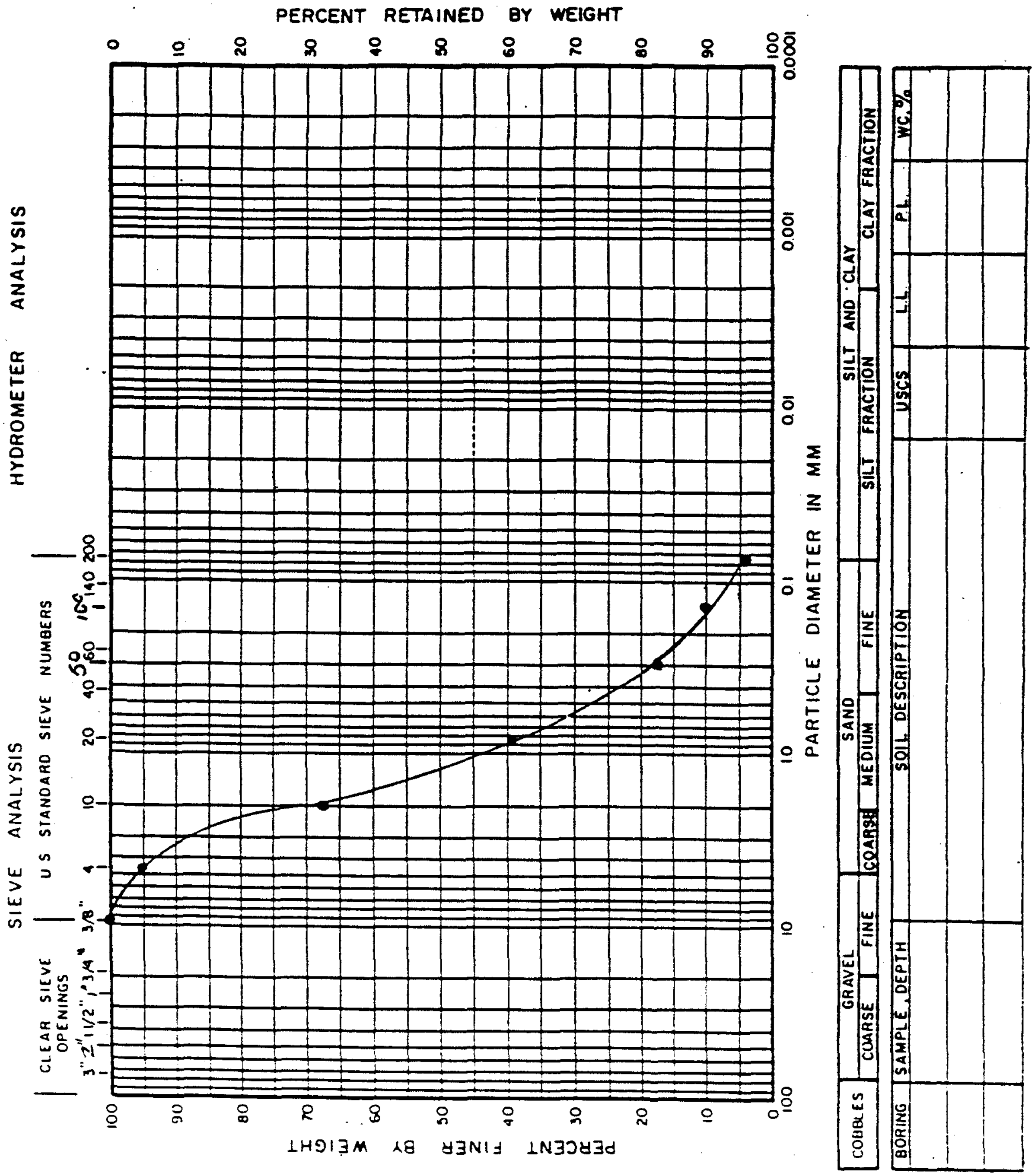
Sample Depth ______ Sample Type ______ Checked by JCL date 26Feb9

Sample Description PS-207C-NE

Sample Preparation Method ______

GRAIN SIZE ANALYSIS

COHESIVE MATERIAL



063-92
22

NUS CORPORATION

Laboratory No. A175769

Sheet ____ of ____

Project Name Rocky Flats Project No. ____ Tested by DN/MDS date 2-16-92

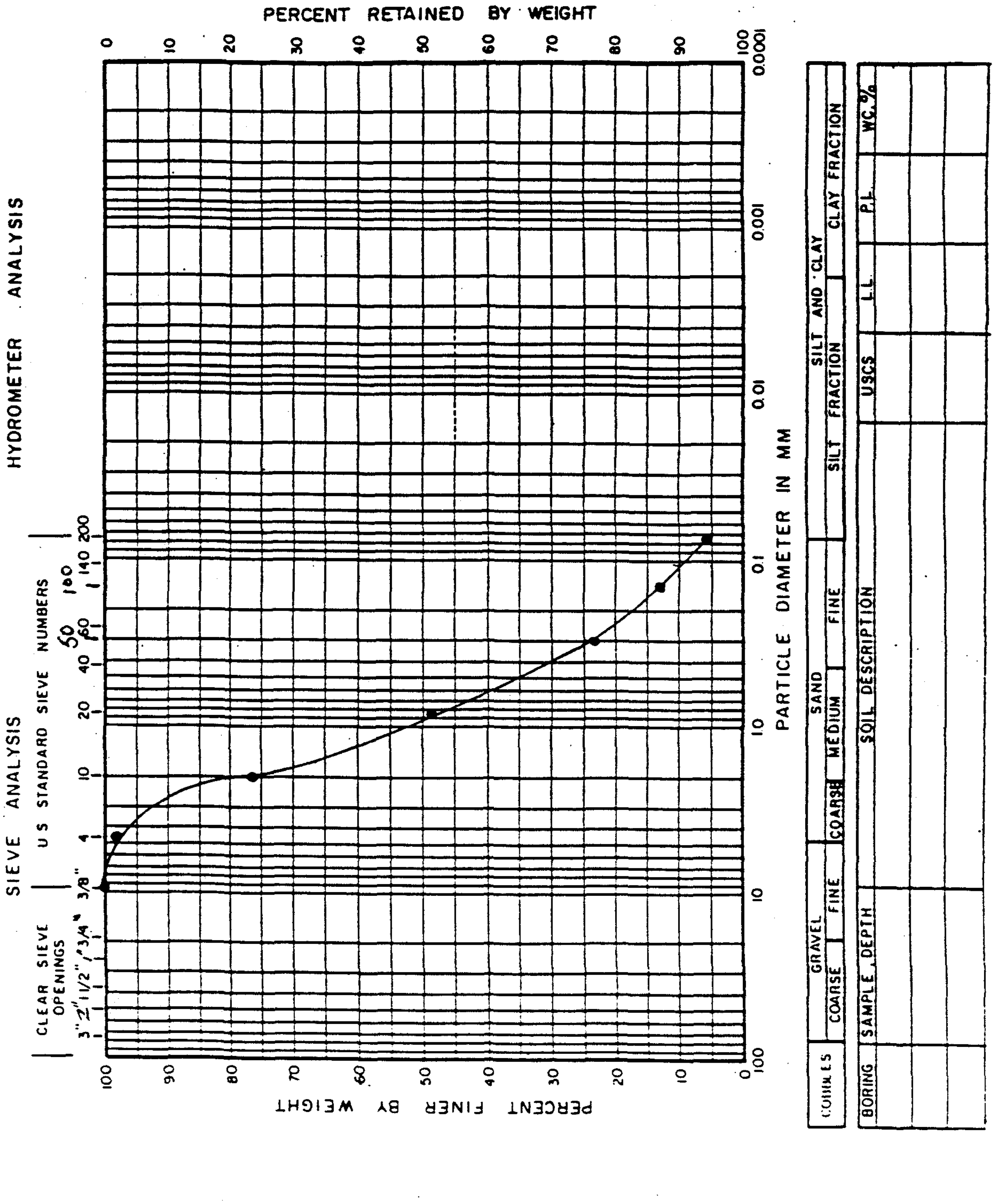
Boring/Test Pit No. ____ Sample No. ____ Calculated by DN date 2-25-92

Sample Depth ____ Sample Type ____ Checked by JCL date 26 Feb 9

Sample Description PS-207C-SE

Sample Preparation Method ____

GRAIN SIZE ANALYSIS
COHESIVE MATERIAL



063-92
23

NUS CORPORATION

Laboratory No. D1757

Sheet ______ of ______

Project Name Rocky Flats Project No. ______ Tested by DN/MDS date 2-16

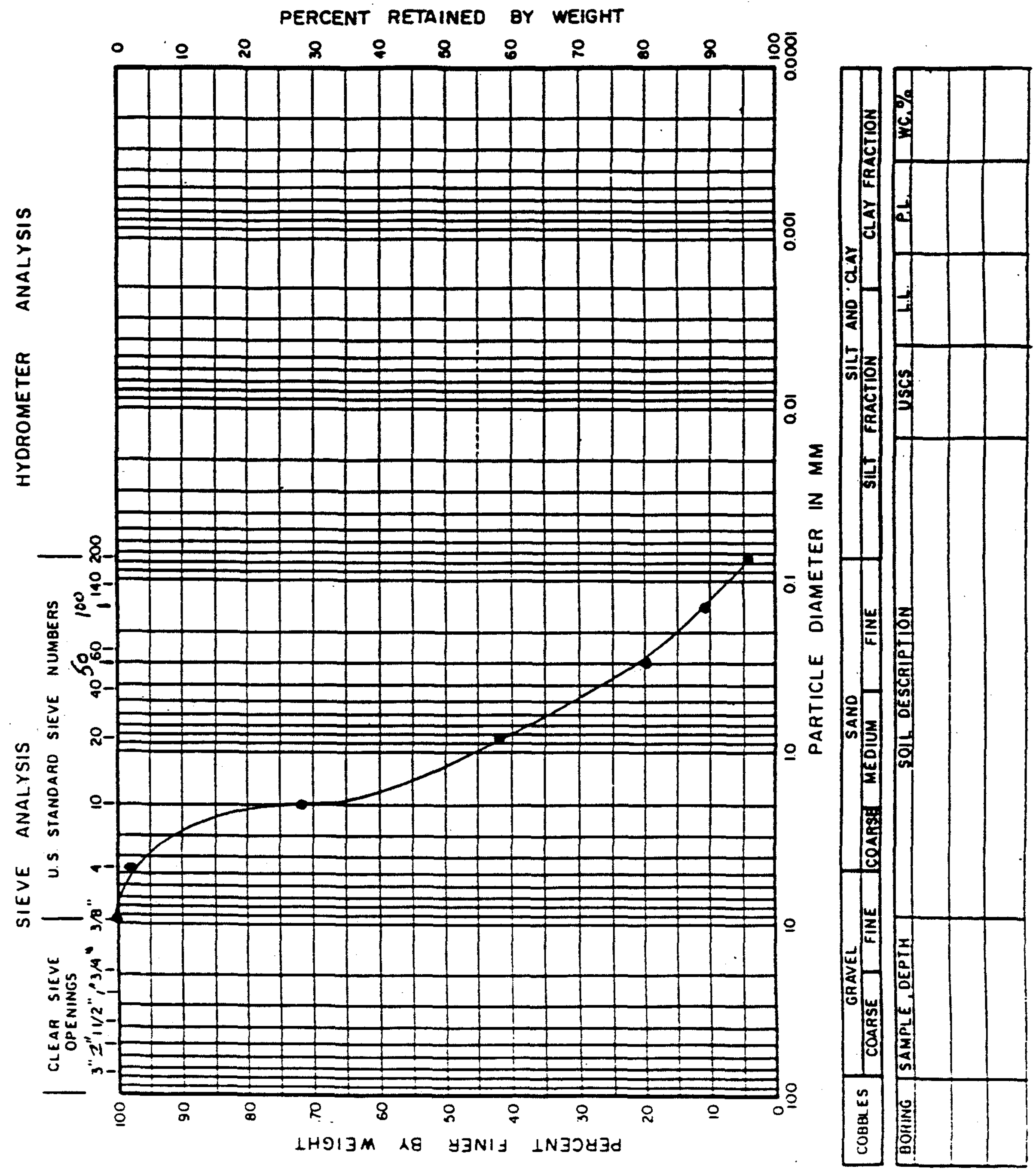
Boring/Test Pit No. ______ Sample No. ______ Calculated by DN date 2-25

Sample Depth ______ Sample Type ______ Checked by JCL date 26 Fe

Sample Description PS-207C-SW

Sample Preparation Method ______

GRAIN SIZE ANALYSIS
COHESIVE MATERIAL



063-92
(24)

ATTACHMENT B

SPECIFICATION SHEETS

FOR

POZZOLAN MATERIALS

MOUNTAIN CEMENT COMPANY
P.O. Box 339
Laramie, Wyoming 82070
(307) 745-4879

LTR # FEBV92

LABORATORY TEST REPORT

SAMPLE: TYPE V DATE 03/04/92

CUSTOMER:

CHEMICAL ANALYSIS	
Silicon dioxide............	22.6
Aluminum oxide.............	3.9
Ferric oxide...............	3.9
Calcium oxide..............	64.8
Magnesium oxide............	0.7
Sulfur trioxide............	2.0
Loss on ignition...........	1.5
Insoluble residue..........	0.22
Total Alk. as Na2O.........	0.54
Na2O.........	0.14
K2O.........	0.61

PHYSICAL TESTS	
Fineness(325 mesh).........	95.9
Specific surface...........	3730
Autoclave..................	-0.050
SET TIMES GILMORE NEEDLES	
Intial set.............	135
Final set...............	300
Air content................	8

COMPOUND COMPOSITION	
Tricalcium silicate........	55
Dicalcium silicate.........	23
Tricalcium aluminate.......	4
Tetracalciumaluminoferrite.	12

COMPRESSION STRENGTHS		
1 Day.....................	1900	
3 Day.....................	3540	
7 Day.....................	4460	
28 Day.....................	5910	JAN92

Mountain Cement Company's cements comply with the requirements of current specifications of ASTM C-150 and AASHTO M85. The above data represents the average of the silo or bin from which this cement was shipped.

Respectfully submitted,

David McNitt

Chief Chemist

WAL

WAL, Inc.

6385 W. 52nd Ave., #5 (303) 420-7700 Arvada, CO 80002

June 6, 1991

Mr. Matt Lahrs
Western Ash Company
4380 S. Syracuse St. Suite 305
Englewood, CO 80155

WAL # 91177-1
Sample ID: COMMANCHE #2

CHEMICAL ANALYSIS
WT%, DRY BASIS

Silicon Dioxide, SiO2	34.86	
Aluminum Oxide, Al2O3	17.96	
Iron Oxide, Fe2O3	5.75	
Total (SiO2 + Al2O3 + Fe2O3)		58.57
Calcium Oxide, CaO	27.93	
Magnesium Oxide, MgO	4.60	
Sodium Oxide, Na2O	1.55	
Potassium Oxide, K2O	0.22	
Titanium Dioxide, TiO2	1.58	
Manganese Dioxide, MnO2	0.16	
Phosphorus Pentoxide, P2O5	1.22	
Strontium Oxide, SrO	0.51	
Barium Oxide, BaO	0.60	
Sulfur Trioxide, SO3	2.59	
Loss on Ignition	0.50	
Moisture, as Received	0.13	

Laboratory Manager

Chemically Pure High Calcium Hydrated Lime

Technical Data

Typical Analysis

Elements	Formula	Percent
Silicon Dioxide	SiO_2	0.92
Iron Oxide	Fe_2O_3	0.29
Aluminum Oxide	Al_2O_3	0.46
Calcium Oxide	CaO	73.0
Magnesium Oxide	MgO	0.65
Sulphur	S	0.015
Phosphorus Pentoxide	P_2O_5	0.011
Manganese	Mn	0.008
Titanium Dioxide	TiO_2	0.019
Carbon Dioxide	CO_2	0.40

Other Tests

Unhydrated Oxides	Less than	1.0
Loss on Ignition	LOI	24.67
Available Calcium Hydroxide	$Ca(OH)_2$	93.0
Total Neutralizing Value in Terms of $CaCO_3$		131.9

Bulk Density	25 - 35 lbs./cu. ft. settled
	20 - 25 lbs./cu. ft. loose

Screen Analysis	100 mesh	99.8 passing
	200 mesh	99.0 passing

This product meets or exceeds the specifications of the American Society for Testing and Materials.

CLS

Centre Lime & Stone Co., Inc.
Off Route 64 & Airport Road
P.O. Box 5130
Pleasant Gap, Pennsylvania 16823-5130

Phone: 814-359-2773
Fax: 814-359-2383

Lime . . . the versatile chemical

REPORT OF FLY ASH ANALYSIS

RESOURCE MATERIALS TESTING, INC.

"Specialists in Fly Ash Testing"

REPORT TO: Western Ash Company
4380 S. Syracuse Street
Suite 305
Denver, CO 80237
Attn: Mr. Harry Roof

PROJECT NO.: RMT-021
SAMPLE NO.: 2381
DATE REC.: 4-5-90
DATE REP.: 5-8-90

PROJECT NAME: Pawnee Plant Fly Ash Q.A. Program

SAMPLE ID: Class C Fly Ash QAP #137 March '91

PARAMETER	RESULTS	ASTM C618 SPEC. F/C
CHEMICAL ANALYSES		
Silicon Dioxide, SiO_2, %	34.1	---
Aluminum Oxide, Al_2O_3, %	20.5	---
Iron Oxide, Fe_2O_3, %	7.2	---
Sum of SiO_2, Al_2O_3, Fe_2O_3, %	61.8	70/50 min
Calcium Oxide, CaO, %	26.1	---
Magnesium Oxide, MgO, %	6.1	---
Sodium Oxide, Na_2O, %	---	---
Potassium Oxide, K_2O, %	---	---
Sulfur Trioxide, SO_3, %	2.7	5.0 max
Moisture Content, %	0.02	3.0 max
Loss on Ignition, %	0.27	6.0 max
Available Alkalies as Na_2O, %*	1.20	1.5 max
PHYSICAL ANALYSES		
Amount Retained on No. 325 Sieve, %	14.1	34 max
Pozzolanic Activity Index		
Portland Cement at 7 days, % of Control	105	75 min
Portland Cement at 28 days, % of Control	109	75 min
Lime at 7 days, psi	---	800/NA min
Water Requirement, % of Control	91	105 max
Autoclave Expansion, %	+0.05	0.8 max
Specific Gravity	2.74	---
Increase of Drying Shrinkage, %*	---	0.03 max
Reactivity with Cement Alkalies, %*		
Reduction of Mortar Expansion, %	---	---
Mortar Expansion, %	---	0.020 max

*Optional requirements applicable only when requested by the purchaser.

By Robert L. Smith

Robert L. Smith, Ph.D.

MATERIAL SAFETY DATA SHEET

CENTRE LIME & STONE CO., INC.
P.O. BOX 130
RTE. 64 & AIRPORT ROAD
PLEASANT GAP, PA 16823

PREPARATION DATE: 02/05/91

INFORMATION PHONE NUMBER
(814) 359-2773

SECTION I - GENERAL INFORMATION

CHEMICAL NAME: Calcium Hydroxide
C.A.S. NUMBER: 1305-62-0
TRADE NAME: Hydrated Lime
FORMULA: $Ca(OH)_2$

SECTION II - HAZARDOUS INGREDIENTS

COMPONENT	CAS NO.	OSHA PEL	ACGIH TLV
Calcium Hydroxide	1305-62-0		5mg/m^3

SECTION III - PHYSICAL DATA

BOILING POINT: 5162°F
MELTING POINT: 540°F
VAPOR PRESSURE (mm Hg): N/A
VAPOR DENSITY (AIR=1): N/A
SPECIFIC GRAVITY (H_2O=1): 2.34
EVAPORATION RATE (Butyl Acetate=1): N/A
SOLUBILITY IN WATER: Negligible
APPEARANCE AND ODOR: White powder, odorless

SECTION IV - FIRE & EXPLOSION HAZARD DATA

FLASH POINT: N/A
FLAMMABLE LIMITS: N/A
EXTINGUISHING MEDIA: Suitable for adjacent materials
UNUSUAL FIRE AND EXPLOSION HAZARDS: None

SECTION V - REACTIVITY DATA

STABILITY: Unstable
MATERIALS TO AVOID: Acidic Compounds

CONDITIONS TO AVOID: Uncontrolled contact with Acidic compounds

HAZARDOUS DECOMPOSITION: None
HAZARDOUS POLYMERIZATION: N/A

SECTION VI - HEALTH HAZARD DATA

ROUTES OF ENTRY: Inhalation, Skin Contact, Ingestion

HEALTH HAZARDS (ACUTE AND CHRONIC):
Inhalation - Moderate upper respiratory irritant
Eye & skin - Caustic chemical burns

CARCINOGENICITY: NTP - NO OSHA Regulated - NO
IARC Monographs - Less than 0.1% crystalline silica

SIGNS & SYMPTOMS OF EXPOSURE:
Moderate caustic irritant to exposed body surfaces including eyes & respiratory tract. Skin redding & eye irritation.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE:
Dust inhalation may aggravate existing respiratory-system disease(s) and/or dysfunctions. Exposure to dust may aggravate existing skin and/or eye conditions.

EMERGENCY AND FIRST AID PROCEDURES:
INHALATION - Remove person to fresh air.
EYES & SKIN - Immediately flush thoroughly with water for at least 15 minutes. Remove contaminated clothing. Get medical attention.
INGESTION - Give person large quantities of water followed by fruit juice. Get medical attention.

SECTION VII - ENVIRONMENTAL PROTECTION PROCEDURES

SPILL RESPONSE: Use normal clean-up procedures: sweep, shovel, vacuum

WASTE DISPOSAL: To be performed in compliance with all current local, state, & Federal regulations.

SECTION VIII - INDUSTRIAL PROTECTION INFORMATION

VENTILATION: Use general or local exhaust ventilation to reduce dust concentration below applicable exposure limits.

RESPIRATORY PROTECTION: NIOSH - MSHA approved dust respirator if dust is generated.

EYE/SKIN: Well fitting safety goggles, protective gloves to prevent skin contact.

HANDLING PRECAUTIONS: Keep product dry. Avoid excessive dust generation.

OTHER PRECAUTIONS: If there is any possibility of eye or skin contact, a supply of clean water should be available to flush affected area. Wear long sleeve shirt and long pants to prevent skin contact. Wash exposed skin with soap and water. Clean work clothes frequently.

POZZOLAN ANALYSES

Material	Gross Alpha Screen	Gross Beta Screen	Available Calcium Oxide
Type "C" Flyash-Pawnee	31±9 pCi/g	19±7 pCi/g	4.6%
Type "C" Flyash-Comanche #2	42±10 pCi/g	29±8 pCi/g	4.0%
Type "V" Mountain Cement	6.5 3 pCi/g	8.32 pCi/g	25.1%

ATTACHMENT C

VALIDATION LETTERS

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-5-2-31

TO:	RICH NINESTEEL	DATE:	MAY 5, 1992
FROM:	DWAYNE S. MOCK	CC:	D. A. SCHEIB

SUBJECT: INORGANIC DATA VALIDATION
ROCKY FLATS
CASE NO. TCLP1, SDG PKG1

Selected TCLP - Extracted TAL Metals:

15/waters/1-4	1-9LSD	7-9LSD
1-9	2-9LSD	8-9LSD
2-9	3-10LSD	9-9LSD
3-10	4-9LSD	
4-8	5-9LSD	
5-9	6-9LSD	

A validation was performed on the inorganic analytical data from Case No. TCLP1, SDG PKG1, water samples collected by HALLIBURTON NUS Environmental Corporation at the Rocky Flats site. The data were reviewed with reference to the EPA "Functional Guidelines for Evaluating Inorganic Analyses" as applied for use within Region VIII, and were evaluated based on the following parameters:

* o Data Completeness
* o Holding Times
* o Calibration Verification
o Laboratory Blank Analyses
* o ICP Interference Check Sample Results
o Matrix Spike Recoveries
* o Laboratory Control Sample Results
o ICP Serial Dilution Results
* o Detection Limits
* o Sample Quantitation

* - All quality control criteria were met for this parameter.

No laboratory duplicate analyses were included in this analytical data set, therefore the data was not evaluated for this parameter. Also, no field duplicate pair was included with this data set.

The attached Table 1 summarizes the validation recommendations which were based on the following information:

Blanks

No field quality control blanks were included with this analytical data set.

Laboratory method blank analyses yielded the following contaminants in the maximum concentrations indicated:

Analyte	Maximum Concentration (ug/l)	Action Level (ug/l)
aluminum	32.0	160
cadmium	5.0	25

Sample Affected: All

Blank Actions:

Value > IDL and < Action Level = Report value U.
Value > IDL and > Action Level = Report value unqualified.

No actions were taken for aluminum, since all results are greater than the action level, or cadmium because all results are nondetects.

Matrix Spike Recoveries

The Matrix Spike (MS) %R for silver was below the 75% quality control limit (yet > 30%). All sample results are nondetects and these are qualified as estimated (UJ). Also, the MS %R for mercury were above the 125% upper quality control limit. No positive results were reported for mercury in any sample, therefore no qualifications were made to the data.

ICP Serial Dilution Results

The ICP Serial Dilution Percent Difference (%D) for barium in sample 2-9LSD exceeded the 10% quality control limit. The positive result for barium in this sample is qualified as estimated, (J).

Overall Assessment of the Data

The data are acceptable for use as qualified except for any rejected data. Several analytes were detected as contaminants in the laboratory method blanks, but no actions were necessary because all results were either nondetects or greater than the action level. All silver nondetects were estimated due to low matrix spike recovery. One analyte result was estimated due to noncompliant serial dilution anlaysis results. No other problems were encountered.

ROCKY FLATS
CASE NO. TCLP1, SDG PKG1

TABLE 1 - RECOMMENDATION SUMMARY

Aluminum		Iron
Arsenic		Lead
Barium	J^1	Mercury
Cadmium		Nickel
Selenium		Chromium
Silver	J^2	Magnesium

If the field is left blank, the qualifier is A - Accept all data.

J^1 - Estimate (J) positive result in sample 2-9LSD because ICP Serial Dilution %Ds exceeded 10%.

J^2 - Estimate (UJ) nondetects in all samples because of low MS recovery.

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-5-2-023

TO:	**RICH NINESTEEL**	**DATE:**	**MAY 5, 1992**
FROM:	**RICKY DEPAUL**	**COPIES:**	**D. A. SCHEIB**

SUBJECT: ORGANIC DATA VALIDATION - TCLP VOAs
ROCKY FLATS
CASE NO. TCLP1, SDG PKG1

SAMPLES:

Volatiles:

2/leachates/207C39, 207C39LSD

A validation was performed on the organic analytical data from the zero headspace extraction volatile fraction analyses of Case No. TCLP1, SDG PKG 1, leachate sample and its additive duplicate prepared by HALLIBURTON NUS Environmental Corporation on 03/12/92 at the Pittsburgh laboratory. No field quality control blanks or field duplicate pairs were included with this analytical data set. The data were reviewed with reference to the EPA "Functional Guidelines for Evaluating Organic Analyses" as applied for use within Region VIII, and were evaluated based on the following parameters:

* • Holding Times
* • Laboratory Method Blank Summary
* • Surrogate Spike Recoveries
* • Compound Identification
* • Compound Quantitation

* - All quality control criteria were met for this parameter.

No problems were encountered in this case.

OVERALL ASSESSMENT

All data are accepted without qualification.

Attachments:

1. Appendix A - Analytical Results

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-5-2-050

TO: RICH NINESTEEL

DATE: MAY 7, 1992

FROM: RICKY DEPAUL

COPIES: D. A. SCHEIB

SUBJECT: MISCELLANEOUS DATA VALIDATION - LEACHATES
ROCKY FLATS
CASE NO. TCLP1, SDG PKG1

SAMPLES:

Total & Amenable Cyanide; pH

15/TCLP Leachates (solids)/207C-

1.4	1.9	2.9	3.10	4.8
5.9	1.9 LSD	2.9 LSD	3.10 LSD	4.9 LSD
5.9 LSD	6.9 LSD	7.9 LSD	8.9 LSD	9.9 LSD

Zero Headspace Extractions (Volatiles)

2/solids/

3.9 3.9 LSD

A validation was performed on the miscellaneous analytical data from the analyses of Case No. TCLP1, SDG PKG 1, samples prepared by HALLIBURTON NUS Environmental Corporation on 3/11/92 and 3/12/92 at the Pittsburgh laboratory. No field quality control blanks or field duplicate pairs were included with this analytical data set. The data were reviewed with reference to the EPA "Functional Guidelines for Evaluating Organic Analyses" as applied for use within Region VIII. Only Form I laboratory sample results and associated raw data were provided with this analytical data set.

Only nondetected sample results were reported for the Zero Headspace Extractions of the volatile organic compounds and total cyanide results in all samples did not exceed 0.02 mg/L.

No problems were encountered in this case.

OVERALL ASSESSMENT

All data are accepted without qualification.

Attachments:

1. Appendix A - Analytical Results.

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-5-2-52

TO:	RICH NINESTEEL	DATE:	MAY 7, 1992
FROM:	DAVID A. YOST DAY	COPIES:	D. A. SCHEIB

SUBJECT: INORGANIC DATA VALIDATION - TCLP LEACHATES
ROCKY FLATS
CASE NO. TCLP2, SDG PKG2

<u>TAL Metals</u>:

15/TCLP Leachates (solids)/

1-LX-7	1A-10	2B-4	2LX-10
3A-2	3LX-10	4LX	5A-2
BAT1B#5	BAT2A#7	BAT4A#8	BAT5#10
BATCH1	BATCH2	BATCH3	

A validation was performed on the inorganic analytical data from Case No. TCLP2, SDG PKG2, soil samples collected by EG&G, Idaho, Inc. at the Rocky Flats site. The data were reviewed with reference to the EPA "Functional Guidelines for Evaluating Inorganic Analyses" as applied for use within USEPA Region VIII, and were evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • Calibrations
- * • Blanks
- * • Interference Check Sample Results
- * • Field Duplicate Precision
- * • Laboratory Control Standard and Duplicate Results
- • ICP Serial Dilution Results
- * • Detection Limits
- * • Sample Quantitation

* - All quality control criteria were met for this parameter.

No matrix spike or laboratory duplicate analyses were performed for this analytical data set. No field duplicate pairs or field quality control blanks were included with this sample set.

<u>The attached Table 1 summarizes the validation recommendations which were based on the following information</u>:

C-49-5-2-52
Mr. Rich Ninesteel
May 7, 1992
Page Two

Blanks

Laboratory method blank analyses yielded the following contaminants in the maximum concentrations indicated:

Contaminant	Maximum Concentration (ug/L)	Action Level (ug/L)
calcium	78.0	390.0
chromium	9.0	45.0

Samples Affected: All

Blank Actions
Value > IDL and < Action Level = Report value U.
Value > IDL and > Action Level = Report value unqualified.

Individual sample size, moisture content and dilution factors were considered prior to the application of all action levels. No actions were taken for calcium and chromium because all positive sample results for these analytes were greater than the action level.

ICP Serial Dilution Results

One ICP Serial Dilution Percent Difference (%D) was greater than 10% when the undiluted sample concentration exceeded 50 x IDL for calcium. The positive sample result reported for this analyte in the affected sample is qualified as estimated, "J".

No other problems were encountered.

Overall Assessment

The data are accepted for use as qualified. One positive sample result for calcium is estimated due to serial dilution percent difference >10%.

ROCKY FLATS
CASE NO. TCLP2, SDG PKG2

TABLE 1 - RECOMMENDATION SUMMARY

Aluminum		Magnesium	
Antimony		Manganese	
Arsenic		Mercury	
Barium		Nickel	
Beryllium		Potassium	
Cadmium		Selenium	
Calcium	J[1]	Silver	
Chromium		Sodium	
Cobalt		Thallium	
Copper		Vanadium	
Iron		Zinc	
Lead		Boron	

If the field is left blank, the qualifier is A, accept all data.

J[1] - Estimate "J" associated positive sample result in affected sample due to serial dilution %D > 10%.

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-5-2-091

TO:	**RICH NINESTEEL**	**DATE:**	**MAY 11, 1992**
FROM:	**RICKY DEPAUL** RCD	**COPIES:**	**D. A. SCHEIB**

SUBJECT: MISCELLANEOUS DATA VALIDATION - LEACHATES
ROCKY FLATS
CASE NO. TCLP2, SDG PKG2

SAMPLES:

Miscellaneous Parameters

Total & Amenable Cyanide, Gross Alpha & Beta Radiological Analyses, Final pH

10/solids/207C-

CLARIFIER 1	CLARIFIER 2	CLARIFIER 3
BAT 1B #5	BAT 2A #7	BAT 4A #8
BATCH 1A-10	BATCH 2B-4	BATCH 3A-2
BAT 5 #10		

5/solids/207C- (W/LATEX)

BATCH 5A-2	BATCH 3LX-10	BATCH 2LX-10
BATCH 1-LX-7	BATCH 4LX	

A validation was performed on the miscellaneous analytical data from the analyses of Case No. TCLP2, SDG PKG 2, samples prepared at the Pittsburgh Laboratory on 4/8/92 and 4/9/92. No field quality control blanks or field duplicate pairs were included with this analytical data set. The data were reviewed with reference to method -specific quality control criteria and the EPA "National Functional Guidelines" as applied for use within Region VIII. Only Form I laboratory sample results and associated raw data were provided with this analytical data set.

The maximum amount of total cyanide present in the associated samples does not exceed 0.033 mg/l. Only nondetected sample results were reported for the analyses of amenable cyanide and gross alpha radiological screen. Only positive results were reported for the gross beta radiological analyses.

No problems were encountered in this case.

OVERALL ASSESSMENT

All data are accepted without qualification.

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-5-2-56

TO:	**RICH NINESTEEL**	**DATE:**	**MAY 8, 1992**
FROM:	**DAVID A. YOST** DAY	**COPIES:**	**D. A. SCHEIB**
SUBJECT:	**INORGANIC DATA VALIDATION - TCLP LEACHATES**		

ROCKY FLATS
CASE NO. TCLP3, SDG PKG3

TAL Metals:

14/TCLP Leachates (solids)/

1A-1	1B-1	1C-1-2	1D-#2
2A-2	2B-2	2C-2-1	2D-2-2
3A-1	3B-2	3C-3-2	3D-#2
4D-#1	5D-#12		

A validation was performed on the inorganic analytical data from Case No. TCLP3, SDG PKG3, soil samples collected by EG&G, Idaho, Inc. at the Rocky Flats site. The data were reviewed with reference to the EPA "Functional Guidelines for Evaluating Inorganic Analyses" as applied for use within USEPA Region VIII, and were evaluated based on the following parameters:

* • Data Completeness
* • Holding Times
* • Calibrations
* • Blanks
* • Interference Check Sample Results
* • Laboratory Control Standard and Duplicate Results
• ICP Serial Dilution Results
* • Detection Limits
* • Sample Quantitation

* - All quality control criteria were met for this parameter.

No matrix spike or laboratory duplicate analyses were performed for this analytical data set. No field duplicate pairs or field quality control blanks were included with this sample set.

The attached Table 1 summarizes the validation recommendations which were based on the following information:

Blanks

Laboratory method blank analyses yielded the following contaminants in the maximum concentrations indicated:

Contaminant	Maximum Concentration (ug/L)	Action Level (ug/L)
barium	2.0	10.0
calcium	72.0	360.0

Samples Affected: All

Blank Actions
Value > IDL and < Action Level = Report value U.
Value > IDL and > Action Level = Report value unqualified.

Individual sample size, moisture content and dilution factors were considered prior to the application of all action levels. No actions were taken for barium and calcium because all positive sample results for these analytes were greater than the action level.

ICP Serial Dilution Results

One ICP Serial Dilution Percent Difference (%D) was greater than 10% when the undiluted sample concentration exceeded 50 x IDL for calcium. The positive result reported for this analyte in the affected sample is qualified as estimated, "J".

No other problems were encountered.

Overall Assessment

The data are accepted for use as qualified. One positive result for calcium in the affected sample is estimated due to serial dilution percent difference >10%.

ROCKY FLATS
CASE NO. TCLP3, SDG PKG3

TABLE 1 - RECOMMENDATION SUMMARY

Aluminum		Magnesium	
Antimony		Manganese	
Arsenic		Mercury	
Barium		Nickel	
Beryllium		Potassium	
Cadmium		Selenium	
Calcium	J[1]	Silver	
Chromium		Sodium	
Cobalt		Thallium	
Copper		Vanadium	
Iron		Zinc	
Lead		Boron	

If the field is left blank, the qualifier is A, accept all data.

J[1] - Estimate "J" associated positive sample results in affected sample due to serial dilution %Ds > 10%.

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-5-2-087

TO:	**RICH NINESTEEL**	**DATE:**	**MAY 11, 1992**
FROM:	**RICKY DEPAUL** RCD	**COPIES:**	**D. A. SCHEIB**

SUBJECT: MISCELLANEOUS DATA VALIDATION - LEACHATES
ROCKY FLATS
CASE NO. TCLP3, SDG PKG3

SAMPLES:

Miscellaneous Parameters

Total & Amenable Cyanide, Gross Alpha & Beta Radiological Analyses, Final pH

14/solids/207C- BATCH

2A-2	3A-1	2B-2	1B-1
1A-1	3-2	2D 2.2	2C 2.1
3C 3.2	1D #2	3D #2	5D #12
4D #1	1C 1.2		

A validation was performed on the miscellaneous analytical data from the analyses of Case No. TCLP3, SDG PKG 3, samples prepared at the Pittsburgh Laboratory on 4/10/92. No field quality control blanks or field duplicate pairs were included with this analytical data set. The data were reviewed with reference to method-specific quality control criteria and the EPA "National Functional Guidelines" as applied for use within Region VIII. Only Form I laboratory sample results and associated raw data were provided with this analytical data set.

The maximum amount of total cyanide present in the associated samples does not exceed 0.026 mg/l. Only nondetected sample results were reported for the analyses of amenable cyanide and gross alpha radiological screen. Only positive results were reported for the gross beta radiological analyses.

No problems were encountered in this case.

OVERALL ASSESSMENT

All data are accepted without qualification.

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-5-2-64

TO:	RICH NINESTEEL	DATE:	MAY 8, 1992
FROM:	DAVID A. YOST DAY	COPIES:	D. A. SCHEIB

SUBJECT: INORGANIC DATA VALIDATION - TCLP LEACHATES
ROCKY FLATS
CASE NO. TCLP4, SDG PKG4

TAL Metals:

19/TCLP Leachates (solids)/

1-AC	1-BC	1CC	2-AC	2BC
2CC	3-AC	3-BC	3CC	4-AC
4-BC	4CC	5-AC	5-BC	5CC
6CC	H2O-2.1	H2O-3.11	H2O-1.11	

A validation was performed on the inorganic analytical data from Case No. TCLP4, SDG PKG4, soil samples collected by EG&G, Idaho, Inc. at the Rocky Flats site. The data were reviewed with reference to the EPA "Functional Guidelines for Evaluating Inorganic Analyses" as applied for use within USEPA Region VIII, and were evaluated based on the following parameters:

* • Data Completeness
* • Holding Times
* • Calibrations
  • Blanks
* • Interference Check Sample Results
* • Laboratory Control Standard and Duplicate Results
* • ICP Serial Dilution Results
* • Detection Limits
* • Sample Quantitation

* - All quality control criteria were met for this parameter.

No matrix spike or laboratory duplicate analyses were performed for this analytical data set. No field duplicate pairs or field quality control blanks were included with this sample set.

The attached Table 1 summarizes the validation recommendations which were based on the following information:

Blanks

Laboratory method blank analyses yielded the following contaminants in the maximum concentrations indicated:

Contaminant	Maximum Concentration (ug/L)	Action Level (ug/L)
aluminum	40.0	200.0
calcium	102.0	510.0
chromium	9.0	45.0
iron	20.0	100.0
magnesium	46.0	230.0

Samples Affected: All

Blank Actions:
Value > IDL and < Action Level = Report value U.
Value > IDL and > Action Level = Report value unqualified.

Individual sample size, moisture content and dilution factors were considered prior to the application of all action levels. No actions were taken for calcium and chromium because all positive sample results for these analytes were greater than the action level.

No other problems were encountered.

Overall Assessment

The data are accepted for use as qualified. Positive sample results within the action levels for aluminum, iron and magnesium were qualified due to laboratory method blank contamination.

ROCKY FLATS
CASE NO. TCLP4, SDG PKG4

TABLE 1 - RECOMMENDATION SUMMARY

Aluminum	A[1]	Magnesium	A[1]
Antimony		Manganese	
Arsenic		Mercury	
Barium		Nickel	
Beryllium		Potassium	
Cadmium		Selenium	
Calcium		Silver	
Chromium		Sodium	
Cobalt		Thallium	
Copper		Vanadium	
Iron	A[1]	Zinc	
Lead		Boron	

If the field is left blank, the qualifier is A, accept all data.

A[1] - Accept data, but raise sample detection limit (where appropriate) to a revised detection limit due to laboratory method blank contamination.

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-5-2-130

TO: MR. RICH NINESTEEL

DATE: MAY 14, 1992

FROM: KELLY A. JOHNSON

COPIES: D.A.SCHEIB

SUBJECT: MISCELLANEOUS DATA VALIDATION - LEACHATES
ROCKY FLATS
CASE NO. TCLP, PKG. 4

SAMPLES:

Miscellaneous/TCLP Leach:

3/waters/207C Settled H_2O -

3.11, 2.10, 1.11

19/clarifier/207C Clarifier -

1AC, 2AC, 3AC, 4AC, 5AC, 1BC, 2BC, 3BC,
4BC, 5BC, 1CC, 2CC, 3CC, 4CC, 5CC, 6CC

PARAMETERS:

Miscellaneous

Total Cyanide, Gross Alpha Screen, Gross Beta Screen, Amenable Cyanide, TCLP Leach pH

A validation was performed on various analytical data from the miscellaneous parameters analyses conducted on TCLP leachates of Case No. TCLP PKG.4 of aqueous samples collected by EG&G Rocky Flats Inc. on April 13, 1992 at the Rocky Flats site.

The data were reviewed with reference to Method-specific quality control criteria and were evaluated based on the following parameters:

* • Holding Times

  * - All quality control criteria were met for this parameter.

OVERALL ASSESSMENT

No qualifications to any sample data were required.The maximum amounts of total and amenable cyanide that existed in environmental samples were 0.02 mg/L, and -3.0 mg/L, respectively. The Gross Alpha Screen results were all nondetects and the maximum Gross Beta

Screen results were 780+/-110 pCi/L.

No quality control data were included in this SDG.

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-5-2-198

TO:	**RICH NINESTEEL**	**DATE:**	**MAY 19, 1992**
FROM:	**DWAYNE S. MOCK**	**CC:**	**D. A. SCHEIB**

SUBJECT: **INORGANIC DATA VALIDATION**
ROCKY FLATS
CASE NO. TCLP7, SDG PKG7

Selected TCLP - Extracted TAL Metals:

16/waters/BAT1-LX, BAT2-LX, BAT3-LX, BAT4-LX
BAT5-LX, BATCH1, BATCH1A, BATCH1B,
BATCH2, BATCH2A, BATCH2B, BATCH3,
BATCH3A, BATCH4A, BATCH5A, CONTROL

A validation was performed on the inorganic analytical data from Case No. TCLP7, SDG PKG7, water samples prepared by laboratory personel at the Pittsburgh Laboratory of HALLIBURTON NUS Environmental Corporation on 4/29/92 for the Rocky Flats site. The data were reviewed with reference to the EPA "Functional Guidelines for Evaluating Inorganic Analyses" as applied for use within Region VIII, and were evaluated based on the following parameters:

* o Data Completeness
* o Holding Times
* o Calibration Verification
o Laboratory Blank Analyses
* o ICP Interference Check Sample Results
* o Laboratory Control Sample Results
o ICP Serial Dilution Results
* o Detection Limits
* o Sample Quantitation

* - All quality control criteria were met for this parameter.

Matrix spikes and laboratory duplicates were not designated for analyses in this SDG, therefore the data were not evaluated for these parameters. Also, no field duplicate pairs were included with this analytical data set.

<u>The attached Table 1 summarizes the validation recommendations which were based on the following information</u>:

<u>Blanks</u>

No field quality control blanks were included with this analytical data set.

Laboratory method blank analyses yielded the following contaminants in the maximum concentrations indicated:

Analyte	Maximum Concentration (ug/l)	Action Level (ug/l)
aluminum	20.0	100
calcium	61.0	305

Sample Affected: All

Blank Actions:

Value > IDL and < Action Level = Report value U.
Value > IDL and > Action Level = Report value unqualified.

Dilution factors were considered prior to the application of all action levels. No actions were taken for aluminum and calcium since all results for these analytes were greater than the action level.

ICP Serial Dilution Results

The ICP Serial Dilution Percent Differences (%Ds) for chromium in samples BAT4-LX and BATCH2A exceeded the 10% quality control limit, when the undiluted sample results exceeded 50X the IDL. The positive results for this analyte in these samples are qualified as estimated, (J).

Overall Assessment of the Data

The data are acceptable for use as qualified. Several analytes were detected as contaminants in the laboratory method blanks, but no actions were necessary because all results were greater than the action levels. Positive results for chromium in samples BAT4-LX and BATCH2A are estimated due to ICP serial dilution %Ds > 10% when the undiluted sample concentrations for this analyte exceeded 50X the IDL. No other problems were encountered.

ROCKY FLATS
CASE NO. TCLP7, SDG PKG7

TABLE 1 - RECOMMENDATION SUMMARY

Aluminum		Iron	
Arsenic		Lead	
Barium		Mercury	
Cadmium		Nickel	
Calcium		Chromium	J[1]
Selenium		Silver	
Magnesium			

If the field is left blank, the qualifier is A - Accept all data.

J[1] - Estimate (J) positive results in samples BAT4-LX and BATCH2A due to ICP Serial Dilution %Ds > 10%.

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-5-2-187

TO: RICH NINESTEEL

DATE: MAY 19, 1992

FROM: RICKY DEPAUL RCD

COPIES: D. A. SCHEIB

SUBJECT: ORGANIC DATA VALIDATION - VOA ZHEs
ROCKY FLATS
CASE NO. TCLP7, SDG PKG7

SAMPLES:

Volatiles:

4/aqueous/207C- & CLAR BATCH #2 WATER BATCH #3A
W/LATEX BATCH #5LX
WATER @ 70 F BATCH #1B

A validation was performed on the organic analytical data from the volatile fraction analyses of Case No. TCLP7, SDG PKG 7, zero headspace extraction leachate samples prepared by HALLIBURTON NUS laboratory personnel at the Pittsburgh Laboratory on 4/29/92. Four associated field quality control blanks were included with this analytical set. No field duplicate pairs were designated for analysis. Additionally, a TCLP matrix spike was not designated for analysis by Halliburton NUS ETG project management; hence the sample data were not evaluated for this parameter. The data were reviewed with reference to the EPA "Functional Guidelines for Evaluating Organic Analyses", as applied for use within Region VIII, and were evaluated based on the following parameters:

* • Data Completeness
* • Holding Times
* • GC/MS Tuning
* • Calibrations
* • Blanks
* • Surrogate Spike Recoveries
* • Internal Standards Performance
* • Compound Identification
* • Compound Quantitation

* - All quality control criteria were met for this parameter.

No problems were encountered in this case.

ADDITIONAL COMMENTS

Sample 207C & CLAR BATCH #2 and its associated field blank were analyzed on the seventh day from sample collection. Precise sampling times could not be obtained since actual chain-of-custodies do not exist. Hence, the data validator is unable to ascertain if holding time exceedances occurred. In the professional judgement of the validator, the sample data is submitted without qualification.

OVERALL ASSESSMENT

All data are accepted without qualification.

Attachments:

1. Appendix A - Analytical Results.

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-5-2-220

TO: MR. RICH NINESTEEL

DATE: MAY 20, 1992

FROM: KELLY A. JOHNSON KAJ

COPIES: D.A.SCHEIB

SUBJECT: MISCELLANEOUS DATA VALIDATION - LEACHATES
ROCKY FLATS SOLAR PONDS TREATABILITY PROJECT
CASE NO. TCLP, PKG. 8

SAMPLES:

Miscellaneous/TCLP Leach:

14/leachates/207C & silt at -

15% TSS Batch - 1A, 2A, 3A

10% TSS Batch - 1B, 2B, 3B

5% TSS Batch - 1C, 2C, 3C

207C W/LATEX at 5% TSS Batch -

1D, 2D, 3D, 4D, 5D

PARAMETERS:

Miscellaneous

Paint Filter Liquids Test, Paint Can Test
Cyanide (Total), Cyanide (Amenable)

ZHE/PART 261 Volatiles

1,1-dichloroethene, 1,2-dichloroethane, 2-butanone, benzene, carbon tetrachloride, chlorobenzene, chloroform, tetrachloroethene, trichloroethylene, vinyl chloride

A validation was performed on the miscellaneous parameters and ZHE/Part 261 volatiles TCLP data from Case No. TCLP8, SDG.8 on 14 leachate samples prepared by HALLIBURTON NUS Environmental Laboratories on April 3, 1992, cured for 28 days and with the leaching procedure performed on May 1, 1992. No field duplicate pairs were included in the analytical data set (also included in the fourteen samples are four ambient condition blanks analyzed along with the ZHE/Part 261 volatiles).

The data were reviewed with reference to method-specific quality control criteria and were evaluated based on the following parameters:

- * • Holding Times
- * • Blanks
- • Matrix Spike/Matrix Spike Duplicate

* - All quality control criteria were met for this parameter.

MATRIX SPIKE/MATRIX SPIKE DUPLICATE

The matrix spike (MS) Percent Recovery (%R) for total cyanide results were (70.1%) which according the laboratory, indicates matrix interference. Therefore positive and nondetected results reported for this analyte are qualified as estimated, (J) and (UJ), respectively.

OTHER COMMENTS

The amenable cyanide results were all reported as negative values and it is not understood by the data validator how results can be quantitated as negative concentrations, therefore all data are considered unreliable and are qualified as rejected (R).

OVERALL ASSESSMENT

According to the laboratory matrix spike %Rs for total cyanide were low indicating matrix interference, and are qualified accordingly. Results reported for amenable cyanide were all negative and are therefore qualified as unuseable.

No other problems with the data were noted.

ROCKY FLATS
TCLP8, PKG.8

TABLE 1 - QUALIFICATION SUMMARY

Paint Filter Liquids Test	
Paint Can Test	
Cyanide, Total	J[1]
Cyanide, Amenable	R[1]
ZHE/PART 261 - Volatiles	

If the field is left blank, the qualifier is A - Accept all data.

J[1] - Estimate (J) positive and (UJ) nondetected results for total cyanide due to matrix interference.

R[1] - Reject (R) all negative results for amenable cyanide because negative concentrations are analytically unsound.

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-5-2-228

TO: MR. RICH NINESTEEL

DATE: MAY 21, 1992

FROM: KELLY A. JOHNSON

COPIES: D.A. SCHEIB

SUBJECT: TCLP VOLATILE ORGANIC DATA VALIDATION - VOA/LEACHATES
ROCKY FLATS SOLAR PONDS TREATABILITY PROJECT
CASE NO. TCLP8, PACKAGE 8

SAMPLES:

<u>Volatiles:</u>

8/leachates/

207C Silt at 15% TSS Batch - 2A Blank, 2A Leach

207C Silt at 10% TSS Batch - 2B Blank, 2B Leach

207C Silt at 5% TSS Batch - 2C Blank, 2C Leach

207C W/Latex at 5% TSS Batch - 3D Blank, 3D Leach

A validation was performed on the volatile organic TCLP data from Case No. TCLP8, Package.8 on 8 leachate samples (including four ambient condition blanks) prepared by HALLIBURTON NUS Environmental Laboratories on April 3, 1992, cured for 28 days and with the leaching procedure performed on May 1, 1992. No field duplicate pairs were included in this analytical data set.

The data were reviewed with reference to method-specific quality control criteria and were evaluated based on the following parameters:

* • Data Completeness
* • Holding Times
* • GC/MS Tuning
* • Calibrations
* • Blanks
• Surrogate Spike Recoveries
* • Internal Standard Performance
* • Compound Identification
* • Compound Quantitation

* - All quality control criteria were met for this parameter.

SURROGATE SPIKE RECOVERIES

The surrogates Percent Recoveries (%Rs) toluene-d8 and bromofluorobenzene exceeded quality control criteria in sample 3D Leach. However since there were no positive results reported for any compound in this sample, no qualifications were necessary.

OVERALL ASSESSMENT

There were non-compliant surrogate %Rs for sample 3D Leach but no data was implicated as there were no positive results in the effected sample.

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-5-2-221

TO:	**MR. RICH NINESTEEL**	**DATE: MAY 20, 1992**
FROM:	**KELLY A. JOHNSON** KAJ	**COPIES: D.A. SCHEIB**
SUBJECT:	**INORGANICS DATA VALIDATION - LEACHATES ROCKY FLATS SOLAR PONDS TREATABILITY PROJECT CASE NO. TCLP8, PACKAGE 8**	

SAMPLES:

Inorganics/TCLP Leach:

14/leachates/207C & silt at -

15% TSS Batch - 1A, 2A, 3A

10% TSS Batch - 1B, 2B, 3B

5% TSS Batch - 1C, 2C, 3C

207C W/LATEX at 5% TSS Batch -

1D, 2D, 3D, 4D, 5D

A validation was performed on the inorganic metals TCLP data from Case No. TCLP8, SDG.8 consisting of 14 leachate samples prepared by HALLIBURTON NUS Environmental Laboratories on April 3, 1992, cured for 28 days and with the leaching procedure performed on May 1, 1992.

The data were reviewed with reference to method-specific quality control criteria and were evaluated based on the following parameters:

- * • Holding Times
- • Laboratory Method Blanks
- * • Calibrations
- * • Laboratory Control Sample
- * • ICP Interference Check
- • ICP Serial Dilutions

* - All quality control criteria were met for this parameter.

Laboratory duplicate, field duplicate samples, and matrix spike analyses were not included in this data set, therefore, the data were not evaluated for these parameters.

All qualifications made to analytical data are summarized at the end of this document in Table 1.

BLANKS

The contaminants found in associated low level laboratory method blank analyses are summarized below:

Compound	Maximum Concentration	Action Level
Calcium	250 ug/L	1250 ug/L
Aluminum	20 ug/L	100 ug/L

Samples Affected: All

Blank Actions:

- o Value < CRQL; report CRQL followed by a U.
- o Value > CRQL and < action level; report value followed by a U.
- o Value > CRQL and > action level; report value unqualified.

Dilution factors were considered prior to application of the action levels. No qualifications were made as there were no positive results within the action levels.

ICP SERIAL DILUTIONS

Serial dilutions were performed for every sample. Several Percent Differences (%D)s for several analytes were greater than 10%, however no data were implicated. The %D for calcium was high in sample 207C W/Latex at 5% TSS Batch 2D, and the positive result for calcium is qualified as estimated (J) in that sample.

OVERALL ASSESSMENT

There were two blank contaminants found however, their reported concentrations in environmental samples exceeded the action levels and thus required no actions. There were also several non-compliant %Ds for serial dilutions, however, only positive results for one sample required action.

ROCKY FLATS
INORGANICS TCLP8, PKG.8

TABLE 1 - QUALIFICATION SUMMARY

Aluminum	
Arsenic	
Barium	
Cadmium	
Calcium	J[1]
Chromium	
Iron	
Lead	
Magnesium	
Mercury	
Nickel	
Selenium	
Silver	

If the field is left blank, the qualifier is A - Accept all data.

J[1] - Estimate (J) positive result for calcium due to ICP serial dilution %D greater than 10%.

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-6-5-068

TO:	RICH NINESTEEL	DATE:	JUNE 5, 1992
FROM:	RICKY C. DEPAUL RCD	CC:	D. A. SCHEIB

SUBJECT: INORGANIC DATA VALIDATION
ROCKY FLATS
CASE NO. TCLP9, SDG PKG9

SELECTED TAL Metals:

19 waters/207C-WATER BATCH- #1, #2, #3

& CLARIFIER BATCH- #1AC, #2AC, #3AC, #4AC,
#5AC, #1BC, #2BC, #3BC,
#4BC, #5BC, #1CC, #2CC,
#3CC, #4CC, #5CC, #6CC

A validation was performed on the inorganic analytical data from Case No. TCLP9, SDG PKG9, TCLP leachate samples prepared by HALLIBURTON NUS Environmental Corporation laboratory personnel at the Pittsburgh laboratory on 5/4/92. The data were reviewed with reference to the EPA "Functional Guidelines for Evaluating Inorganic Analyses" as applied for use within USEPA Region VIII, and were evaluated based on the following parameters:

* o Data Completeness
* o Holding Times
* o Calibration Verification
o Laboratory Blank Analyses
* o ICP Interference Check Sample Results
* o Laboratory Control Sample Results
o ICP Serial Dilution Results
* o Detection Limits
* o Sample Quantitation

* - All quality control criteria were met for this parameter.

<u>The attached Table 1 summarizes the validation recommendations which were based on the following information</u>:

Laboratory and field duplicates, matrix spike analyses and CRDL Standard analyses were not included with this analytical data set; hence the sample data were not evaluated for these parameters.

<u>Blanks</u>

No field quality control blanks were included with this analytical data set. Preparation blank analysis yielded the following contaminants in the maximum concentrations indicated:

Analyte	Maximum Concentration (ug/l)	Action Level (ug/l)
aluminum	73.0	365
calcium	89.0	445

Sample Affected: All

Blank Actions:

Value > IDL and < Action Level = Report value U.
Value > IDL and > Action Level = Report value unqualified.

Individual sample size and dilution factors were considered prior to the application of all action levels. No actions were taken for any of the above analytes because all sample concentrations for these analytes are above the action level.

ICP Serial Dilution Results

The Serial Dilution Percent Differences (%Ds) exceeded 10% when the undiluted sample results exceeded 50X IDL for barium in samples 207C & CLAR BATCH #4 CC and 207C & CLAR BATCH #6 CC. Positive sample results were reported for this analyte in the affected samples and these results are qualified as estimated, "J".

Additional Comments

Barium, which is not supposed to be present in the ICS Solution A, was found at concentrations greater than 2X the IDL. Additionally, the interferant analyte calcium was present in all samples at concentrations greater than 50% of that found in the ICS solution. However, estimated elemental interferances were < 10% of the reported sample concentrations for barium and no further actions were taken.

Overall Assessment of the Data

The data are acceptable for use as qualified. Calcium and aluminum were found as contaminants in the preparation blanks. All positive sample results for these analytes were greater than the action levels and no further actions were required. Positive sample results for barium in two samples are estimated because serial dilution percent differences exceeded 10% when the undiluted sample results were > 50X the IDL. Barium which was not supposed to be present in ICS solution A, was found at concentrations > 2X IDL.

Additionally, calcium was present in all samples at concentrations > 10% of the respective ICS level for this interferant analyte. However, calculations of estimated elemental interferences dictate that no further actions are required.

No other problems were encountered.

ROCKY FLATS
CASE NO. TCLP9, SDG PKG9

TABLE 1 - RECOMMENDATION SUMMARY

Aluminum		Magnesium	
Antimony		Manganese	
Arsenic		Mercury	
Barium	J[1]	Nickel	
Beryllium		Potassium	
Cadmium		Selenium	
Calcium		Silver	
Chromium		Sodium	
Cobalt		Thallium	
Copper		Vanadium	
Iron		Zinc	
Lead		Boron	

If the field is left blank, the qualifier is A - Accept all data.

J[1] - Estimate "J" positive sample results in the affected samples due to serial dilution %D > 10%.

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-6-2-69

TO:	**RICH NINESTEEL**	**DATE:**	**JUNE 5, 1992**
FROM:	**KENT WEAVER**	**COPIES:**	**D. A. SCHEIB**

SUBJECT: ORGANIC DATA VALIDATION - TCLP VOAs
ROCKY FLATS
CASE NO. TCLP9, SDG PKG9

SAMPLES:

Volatiles:

8/aqueous/	3ACBLANK	3ACLEACH	3BCBLANK
	3BCLEACH	3CCBLANK	3CCLEACH
	SWBLANK	SWLEACH	

A validation was performed on the Toxic Characteristic Leaching Procedure (TCLP) organic analytical data from the volatile fraction analyses of Case No. TCLP9, SDG PKG9, low level aqueous samples collected by HALLIBURTON NUS Environmental Corporation on 5/04/92 at the Rocky Flats site. Four field blanks were included with this analytical set. The data were reviewed with reference to the EPA "Functional Guidelines for Evaluating Organic Analyses" as applied for use within Region VIII and were evaluated based on the following parameters:

* • Data Completeness
* • Holding Times
* • GC/MS Tuning
* • Calibrations
* • Blanks
* • Surrogate Spike Recoveries
* • Internal Standard Performance
* • Compound Identification
* • Compound Quantitation

* - All quality control criteria were met for this parameter.

No problems were encountered in this case.

OVERALL ASSESSMENT

All data are accepted without qualification. The "date received" on the volatile fraction Form 1 for sample 3BCLEACH was reported incorrectly. The true date of reception by the laboratory (05/04/92) was transposed over to the associated Form 1. No qualifications were necessary.

Attachments:

1. Appendix A - Qualified Analytical Results

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-6-5-073

TO: RICH NINESTEEL **DATE:** JUNE 5, 1992

FROM: RICKY DEPAUL RCD **COPIES:** D. A. SCHEIB

SUBJECT: MISCELLANEOUS DATA VALIDATION - LEACHATES
ROCKY FLATS
CASE NO. TCLP9, SDG PKG9

SAMPLES:

Miscellaneous Parameters

Total & Amenable Cyanide, Final pH

19/solids/207C-WATER BATCH #1, #2, #3

& CLAR BATCH #1AC, #2AC, #3AC, #4AC, #5AC,
#1BC, #2BC, #3BC, #4BC, #5BC,
#1CC, #2CC, #3CC, #4CC, #5CC,
#6CC

A validation was performed on the miscellaneous analytical data from the analyses of Case No. TCLP9, SDG PKG 9, samples prepared at the Pittsburgh Laboratory on 5/4/92. No field duplicates or field quality control blanks were included with this analytical data set. The data were reviewed with reference to method-specific quality control criteria and the EPA "National Functional Guidelines" as applied for use within Region VIII. Only Form I laboratory sample results and associated raw data were provided with this analytical data set.

The maximum amount of total cyanide present in the associated samples does not exceed 0.032 mg/l. Only nondetected sample results were reported for the analyses of amenable cyanide.

No problems were encountered in this case.

OVERALL ASSESSMENT

All data are accepted without qualification.

Attachments:

1. Appendix A - Analytical Results

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

Rec'd 6-19-92

C-49-6-2-113

TO:	**RICH NINESTEEL**	**DATE:**	**JUNE 11, 1992**
FROM:	**RICKY C. DEPAUL** RCD	**CC:**	**D. A. SCHEIB**

SUBJECT: INORGANIC DATA VALIDATION
ROCKY FLATS
CASE NO. TCLP10, SDG PKG10

Selected TCLP - Extracted TAL Metals:

20/waters/207 A/B BATCH #1TA, #2TA, #3TA, #4TA, #5TA
#1TB, #2TB, #3TB, #4TB, #5TB
#1TC, #2TC, #3TC, #4TC, #5TC
#1TD, #2TD, #3TD, #4TD, #5TD

A validation was performed on the inorganic analytical data from Case No. TCLP10, SDG PKG10, leachate samples prepared by HALLIBURTON NUS Environmental Corporation laboratory personnel at the Pittsburgh laboratory on 5/6/92 and 5/7/92. The data were reviewed with reference to the EPA "Functional Guidelines for Evaluating Inorganic Analyses" as applied for use within USEPA Region VIII, and were evaluated based on the following parameters:

* o Data Completeness
* o Holding Times
* o Calibration Verification
  o Laboratory Blank Analyses
* o ICP Interference Check Sample Results
  o Matrix Spike Recoveries
* o Laboratory Control Sample Results
  o ICP Serial Dilution Results
* o Detection Limits
* o Sample Quantitation

* - All quality control criteria were met for this parameter.

<u>The attached Table 1 summarizes the validation recommendations which were based on the following information</u>:

Laboratory and/or field duplicate analyses and CRDL Standard analyses were not included with this analytical data set; hence the data were not evaluated for these parameters.

<u>Blanks</u>

No field quality control blanks were included with this analytical data set. Laboratory method and preparation blank analyses yielded the following contaminants in the maximum concentrations indicated:

Analyte	Maximum Concentration (ug/l)	Action Level (ug/l)
aluminum	152	760
barium	2.0	10.0
calcium	188	940
cadmium	5.0	25.0
chromium	14.0	70.0
iron	51.0	255
magnesium	157	785

Sample Affected: All

Blank Actions:

Value > IDL and < Action Level = Report value U.
Value > IDL and > Action Level = Report value unqualified.

Individual sample size and dilution factors were considered prior to the application of all action levels. No actions were taken for aluminum, barium and calcium because all sample concentrations for these analytes are above the action levels. Also, no qualifications were made for cadmium since all sample results for this analyte were nondetects.

Matrix Spike Recoveries

The Matrix Spike (MS) Percent Recoveries (%Rs) for barium and calcium were extremely low,(< 30%). Only positive sample results were reported for these analytes and these results are qualified as estimated, "J". The MS %Rs for lead and silver were less than 75%, yet greater than 30%. Only nondetected sample results were reported for these analytes and these results are qualified as estimated, "UJ".

ICP Serial Dilution Results

The ICP Serial Dilution Percent Differences (%Ds) for barium exceeded 10% in sample 207 A/B BATCH #5TC when the undiluted sample result exceeded 50X the IDL. The positive sample result for this analyte in this sample is qualified as estimated, "J". The serial dilution %Ds for aluminum in samples 207 A/B BATCH #1TD and 207 A/B BATCH #2TD were greater than 10% when the undiluted sample results for this analyte exceeded 50X the IDL. The positive sample results for this analyte in these samples are qualified as estimated, "J".

Overall Assessment of the Data

The data are acceptable for use as qualified. Aluminum, barium, calcium, cadmium, chromium, iron and magnesium were found as contaminants in the laboratory method and preparation blanks. All positive sample results for calcium, aluminum and barium were greater than the action levels and no further actions are required. Positive sample results for barium and calcium are estimated due to extremely low matrix spike recoveries. Nondetected sample results for silver and lead are estimated due to low matrix spike recoveries. Positive sample results for barium and aluminum are estimated in the affected samples due to serial dilution %Ds which exceeded 10% when the undiluted sample results were greater than 50X the IDL. Barium, which was not supposed to be present in the ICS solution was present at concentrations greater than 2X the IDL. Additionally, calcium was present in all samples at concentrations > 50% of the respective ICS level for this interferant analyte. However, calculations of estimated elemental interferences dictate that no qualifications are necessary. No other problems were encountered.

ROCKY FLATS
CASE NO. TCLP10, SDG PKG10

TABLE 1 - RECOMMENDATION SUMMARY

Aluminum	J^3	Magnesium	A^1
Antimony		Manganese	
Arsenic		Mercury	
Barium	$J^{1,3}$	Nickel	
Beryllium		Potassium	
Cadmium		Selenium	
Calcium	J^1	Silver	J^2
Chromium	A^1	Sodium	
Cobalt		Thallium	
Copper		Vanadium	
Iron	A^1	Zinc	
Lead	J^2	Boron	

If the field is left blank, the qualifier is A - Accept all data.

A^1 - Accept data, but raise sample detection limit (where appropriate) to a revised detection limit due to blank contamination.

J^1 - Estimate "J" positive sample results due to extremely low (< 30%) matrix spike recoveries.

J^2 - Estimate "UJ" nondetected sample results due to low matrix spike recoveries < 75%, but > 30%.

J^3 - Estimate "J" positive sample results in affected samples due to serial dilution %Ds > 10%.

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-6-2-092

TO: RICH NINESTEEL **DATE:** JUNE 8, 1992

FROM: RICKY DEPAUL RCD **COPIES:** D. A. SCHEIB

SUBJECT: ORGANIC DATA VALIDATION - VOA ZHEs
ROCKY FLATS
CASE NO. TCLP10, SDG PKG10

SAMPLES:

Volatiles:

4/aqueous/207 A/B BATCH- #3TA, #3TB, #3TC, #3TD

A validation was performed on the organic analytical data from the volatile fraction analyses of Case No. TCLP10, SDG PKG 10, zero headspace extraction leachate samples prepared by HALLIBURTON NUS laboratory personnel at the Pittsburgh Laboratory on 5/7/92. Four associated field quality control blanks were included with this analytical set. No field duplicate pairs were designated for analysis. Additionally, a TCLP matrix spike was not designated for analysis by Halliburton NUS ETG project management; hence the sample data were not evaluated for this parameter. The data were reviewed with reference to the EPA "Functional Guidelines for Evaluating Organic Analyses", as applied for use within Region VIII, and were evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- • Calibrations
- • Blanks
- * • Surrogate Spike Recoveries
- * • Internal Standards Performance
- * • Compound Identification
- * • Compound Quantitation

* - All quality control criteria were met for this parameter.

<u>The attached Table 1 summarizes the validation qualifications which were based on the following information:</u>

CALIBRATIONS

The followig tables summarize calibration noncompliances and corresponding actions. The key associated with these tables is presented below.

Compound	CC 5/16/92	CC 5/17/92
1,2-dichloroethane	X	X
Associated Samples:	3TABLANK, 3TCLEACH 3TBLEACH, 3TCBLANK 3TBBLANK, 3TDLEACH 3TDBLANK	3TALEACH

Only nondetected sample results were reported for 1,2-dichloroethane in the associated samples; no actions were taken.

Calibration Key:

+ - RF < 0.050; Estimate (J) positive results and reject (R) nondetects.
X - Percent RSD > 30; percent D > 25; Estimated (J) positive results.
XX - Percent RSD > 50; percent D > 50; Estimate (J) positive results and estimate (UJ) nondetects.

BLANKS

The maximum concentration of contaminants found in the associated low-level laboratory method, and field quality control blank analyses is summarized below:

Compound	Maximum Concentration (ug/l)	Action Level (ug/l)
2-butanone	16	160

Samples Affected: All

Blank Actions:

- o Value < CRQL; report CRQL followed by a U.
- o Value > CRQL and < action level; report value followed by a U.
- o Value > CRQL and > action level; report value unqualified.

Dilution factors were considered prior to the application of the action levels.

No other problems were encountered with this case.

OVERALL ASSESSMENT

The compound 2-butanone was found as a contaminant in the laboratory method and field quality control blanks. The continuing calibration %Ds for 1,2-dichloroethane on 5/16/92 and 5/17/92 were noncompliant. However, only nondetects were reported for this compound and no actions were taken.

Attachments:

1. Appendix A - Qualified Analytical Results.
2. Appendix B - Support Documentation.

ROCKY FLATS
TCLP10, SDG PKG10

TABLE 1 - QUALIFICATION SUMMARY

Sample No.	Volatile
3TALEACH	A[1]
3TBLEACH	A[1]
3TCLEACH	A[1]
3TDLEACH	A[1]
3TABLANK	A[1]
3TBBLANK	A[1]
3TCBLANK	A[1]
3TDBLANK	A[1]

If the field is left blank, the qualifier is A - Accept all data.

A[1] - Accept data, but change positive result for 2-butanone to a revised detection limit because of blank contamination.

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

Rec'd 6-19-92

C-49-6-2-102

TO:	**RICH NINESTEEL**	**DATE:**	**JUNE 10, 1992**
FROM:	**RICKY DEPAUL** RCD	**COPIES:**	**D. A. SCHEIB**

SUBJECT: MISCELLANEOUS DATA VALIDATION
ROCKY FLATS
CASE NO. TCLP10, SDG PKG10

SAMPLES:

Miscellaneous Parameters

Paint can filter liquids test, Paint can test

20/solids/207 A/B BATCH #1TA, #2TA, #3TA, #4TA, #5TA,
#1TB, #2TB, #3TB, #4TB, #5TB,
#1TC, #2TC, #3TC, #4TC, #5TC
#1TD, #2TD, #3TD, #4TD, #5TD

A validation was performed on the miscellaneous analytical data from the analyses of Case No. TCLP10, SDG PKG 10, samples prepared at the Pittsburgh Laboratory on 5/6/92. No field duplicates or field quality control blanks were included with this analytical data set. The data were reviewed with reference to method-specific quality control criteria and the EPA "National Functional Guidelines" as applied for use within Region VIII. Only Form I laboratory sample results and associated raw data were provided with this analytical data set.

The paint can filter liquids test references a method used to determine the presence of free liquids in a representative sample of waste. Determination as to whether the material is deemed to contain free liquids is conducted. All samples report a zero milliliter (0 ml) result for this analysis. Additionally, the paint can test reports only solids for all samples.

No problems were encountered in this case.

OVERALL ASSESSMENT

All data are accepted without qualification.

Attachments:

1. Appendix A - Analytical Results

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-6-2-100

TO:	**RICH NINESTEEL**	**DATE:**	**JUNE 10, 1992**
FROM:	**DWAYNE S. MOCK**	**CC:**	**D. A. SCHEIB**

SUBJECT: **INORGANIC DATA VALIDATION**
ROCKY FLATS
CASE NO. TCLP11, SDG PKG11

Selected TCLP - TAL Metals:

4/waters/BATCH- #1, #2, #3, #4

A validation was performed on the inorganic analytical data from Case No. TCLP11, SDG PKG11, leachate samples prepared by laboratory personnel at the Pittsburgh Laboratory of HALLIBURTON NUS Environmental Corporation on 5/15/92 for the Rocky Flats site. The data were reviewed with reference to the EPA "Functional Guidelines for Evaluating Inorganic Analyses" as applied for use within Region VIII, and were evaluated based on the following parameters:

* o Data Completeness
* o Holding Times
* o Calibration Verification
o Laboratory Blank Analyses
* o ICP Interference Check Sample Results
* o Laboratory Control Sample Results
* o ICP Serial Dilution Results
* o Detection Limits
* o Sample Quantitation

* - All quality control criteria were met for this parameter.

Matrix spikes and laboratory duplicates were not designated for analyses in this SDG, therefore the sample data were not evaluated for these parameters. Also, no field duplicate pairs were included with this analytical data set.

The attached Table 1 summarizes the validation recommendations which were based on the following information:

Blanks

No field quality control blanks were included with this analytical data set.

Laboratory method blank analyses yielded the following contaminants in the maximum concentrations indicated:

Analyte	Maximum Concentration (ug/l)	Action Level (ug/l)
aluminum	22.0	110
barium	5.0	25
cadmium	5.0	25
calcium	58.0	290

Sample Affected: All

Blank Actions:

Value > IDL and < Action Level = Report value U.
Value > IDL and > Action Level = Report value unqualified.

Individual sample size and dilution factors were considered prior to the application of all action levels. No actions are taken for aluminum, barium, and calcium since all results for these analytes were greater than the action level. Only nondetects were reported for cadmium.

Additional Comments

Barium which was not supposed to be present in the ICS solution A was found at concentrations which exceeded 2X IDL for this analyte. Additionally, calcium was present in all samples at levels greater than 50% of that reported in the ICS solution. However, calculations of estimated elemental interferences from calcium dictate that no actions are required.

Overall Assessment of the Data

The data are acceptable for use without qualification. Several analytes were detected as contaminants in the laboratory method blanks, but no actions were necessary because all results were greater than the action levels. No other problems were encountered.

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-6-2-118 Rec'd 6-12-92

TO: MR. RICH NINESTEEL

DATE: JUNE 11, 1992

FROM: KELLY A. JOHNSON KAJ

COPIES: D.A.SCHEIB

SUBJECT: INORGANIC DATA VALIDATION - LEACHATES
ROCKY FLATS SOLAR PONDS TREATABILITY STUDY
CASE NO. TCLP12, SDG PKG. 12

SAMPLES:

Inorganics/TCLP Leach:

9 Leachates/207C water - #1A, #2A, #3A

207C water and silt Batch - #1B, #2B, #3B

207C water and clarifier Batch- #1C, #2C, #3C

A validation was performed on the inorganic TCLP leachates from Case No. TCLP12, SDG PKG 12 on 9 leachate samples prepared by HALLIBURTON NUS Environmental Laboratories on May 13, 1992 and cured for 7 days and with the leaching procedure performed on May 20, 1992. No field duplicate pairs were included in the analytical data set.

The data were reviewed with reference to the EPA "Functional Guidelines for evaluating Inorganic Analyses" as applied for use within USEPA Region VIII, and were evaluated based on the following parameters:

* • Data Completeness
* • Holding Times
* • Calibration Verification
• Laboratory Blank Analyses
* • Laboratory Control Sample Results
• ICP Interference Check Sample Results
• ICP Serial Dilution Results
* • Detection Limits
* • Sample Quantitation

* - All quality control criteria were met for this parameter.

The attached Table 1 summarizes the validation recommendations which are based on the following information:

Laboratory duplicate samples, field quality control blanks and matrix spike analyses were not included in this analytical data set, therefore, the data were not evaluated for these parameters.

BLANKS

Laboratory method and preparation blank analyses yielded the following contaminants in the maximum concentrations indicated:

Analyte	Maximum Concentration (ug/L)	Action Level (ug/L)
calcium	41.0	205.0
aluminum	39.0	195.0
barium	3.0	15.0
magnesium	24.0	120.0
chromium	9.0	45.0

Samples Affected: All

Blank Actions:
- o Value < IDL and < Action Level; report value followed by a U.
- o Value > IDL and > action level; report value unqualified.

Individual sample size and dilution factors were considered prior to application of the action levels. No actions were taken for calcium, barium, and chromium as all sample concentrations for these analytes are above the action levels.

ICP INTERFERENCE CHECK

Silver which was not supposed to be present in the ICS solution was present in concentrations greater than two times the IDL. Additionally, calcium was present in all samples at concentrations greater than 50% of the respective ICS level for this interferant analyte. Calculations of estimated elemental interferences were also greater than 50% of the reported sample concentration for silver. All sample results for silver were nondetects, and it is in the professional opinion of the data reviewer that the very large amounts of calcium greatly masked any amounts of silver present in all samples. All sample results for silver are rejected, qualified (R). Barium was also detected in the ICS solution at concentrations greater than two times the IDL. However, calculations of the estimated elemental interferences dictate that no further actions be taken.

ICP SERIAL DILUTIONS

The Percent Differences (%Ds) for barium in samples 207C water #1A and 207C water #2A were greater than 10% when the undiluted sample concentrations exceeded 50 times the IDL. The positive sample results for these analytes in these samples are qualified as estimated (J).

OVERALL ASSESSMENT

Calcium, aluminum, barium, magnesium, and chromium were found as contaminants in the laboratory method and preparation blanks. Barium which was not supposed to be present in the ICS solution A, was present at concentrations > 2 times the IDL. However, calculations of estimated elemental interferences, dictate that no actions be taken. Nondetects for silver are considered to be unreliable and are rejected due to gross interference by calcium. Positive sample results for calcium in samples 207C water #1A and #2A are estimated due to serial dilution %Ds > 10%.

No other problems were noted.

ROCKY FLATS
CASE NO. TCLP12, SDG PKG12

TABLE 1 - QUALIFICATION SUMMARY

Aluminum	A[1]
Arsenic	
Barium	J[1]
Cadmium	
Calcium	
Chromium	
Iron	
Lead	
Magnesium	A[1]
Mercury	
Nickel	
Selenium	
Silver	R[1]

If the field is left blank, the qualifier is A - Accept all data.

A[1] - Qualify nondetected (U) due to blank contamination.

J[1] - Estimate (J) positive results in affected samples due to ICP serial dilution %Ds > 10%.

R[1] - Reject (R) nondetected sample results due to ICP/ICS interference from calcium.

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-6-2-112 Rec'd 6-18-92

TO: **MR. RICH NINESTEEL** **DATE: JUNE 11, 1992**

FROM: **KELLY A. JOHNSON** KAJ **COPIES: D.A.SCHEIB**

SUBJECT: **MISCELLANEOUS DATA VALIDATION - LEACHATES**
ROCKY FLATS SOLAR PONDS TREATABILITY STUDY
CASE NO. TCLP12, SDG PKG 12

SAMPLES:

Miscellaneous/TCLP Leach:

9 Leachates/207C water - #1A, #2A, #3A

207C water and silt batch - #1B, #2B, #3B

207C water and clarifier batch - #1C, #2C, #3C

PARAMETERS:

Miscellaneous

Total and Amenable cyanide, TCLP Leach pH

A validation was performed on the miscellaneous TCLP parameters from Case No. TCLP12, SDG PKG 12 on 9 leachate samples prepared by HALLIBURTON NUS Environmental Laboratories on May 13, 1992 and cured for 7 days. The leaching procedure was performed on May 20, 1992. No field duplicate pairs were included in this analytical data set.

The data were reviewed with reference to Method-specific quality control criteria and were evaluated based on the following parameters:

* • Holding Times

* - All quality control criteria were met for this parameter.

OVERALL ASSESSMENT

No qualifications to any sample data were required. The total cyanide maximum detection was 1.2 mg/L. All amenable cyanide results were negative. No quality control data were included.

ATTACHMENT D

CALCULATIONS

HALLIBURTON NUS Environmental Corporation and Subsidiaries — STANDARD CALCULATION SHEET

CLIENT: EG&G	FILE NO.: 2K68	BY: Mark Speranza	PAGE 1 OF
SUBJECT: Pond 207C Waste Loading		CHECKED BY: RS	DATE: 5/18/92

The following provides back-up for Table 2-1.

Batches 1-5 (mix date - 2/13/92)

Total solids = 40.0% - based on laboratory analysis see laboratory Notebook 25 pg. Book # P042-9

Total Dissolved Solids = 27.3% - based on labortory analysis (Sample No. - P0190478)

result is reported at 358,000 mg/L
Specific gravity = 1.312 (P0190477)

$$TDS = 358{,}000/1.312 = 272865 \text{ or } 27.3\%$$

Total Suspended Solids = 9.3% - based on laboratory analysis See Laboratory Notebook pg.

Batches 6-8 (mix date 4/6/92)

Total Solids = 38.6% - based on laboratory analysis See Laboratory Notebook 35 pg. Book # P109-92

Total Dissolved Solids = 34.1% - based on laboratory analysis (Sample No. - P0195050)

No specific gravity data available: therefore it was assumed to be 1.321 base on the following:

Total solids = 510,000 mg/l from lab
Total solids = 38.6% from treatability room

$$S.G. = 510{,}000/386{,}000 = 1.321$$

$$TDS = 450{,}000/1.321 = 34.1\%$$ (TDS sample No. P0195050)

Total Suspended Solids = ~~3~~ 0.9% - based on laboratory analysis See Laboratory Notebook 101 Pg Book # P109-92

HALLIBURTON NUS Environmental Corporation and Subsidiaries STANDARD CALCULATION SHEET

CLIENT: EG&G	FILE NO.: 2K68	BY: Mark Speranza	PAGE 2 OF
SUBJECT: Pond 207C Waste Loading		CHECKED BY:	DATE: 5/18/92

Batches 9-11 (Mix Date 4/3/92)

Total Solids = 35% - based on laboratory analysis see laboratory notebook 29 pg Book No P109-92 (Microwave result after Remix)

Total dissolved solids = 33.1% This value was calculated to obtain a slurry of 7.4% TSS 7L of 207C slurry at 34.1% TDS was mixed with 7L of 207C slurry at 32.1% TDS

$$\therefore \quad \frac{7(.341) + 7(.321)}{14} = 33.1\%$$

Note: The value of 32.1% TDS is also calculated as explained for Batches 19-21, therefore the value of 33.1% is only an approximate number.

Total Suspended solids = 7.4% - based on laboratory analysis see laboratory notebook 22 pg. (Submission #3) Book No. P109-92

HALLIBURTON NUS Environmental Corporation and Subsidiaries STANDARD CALCULATION SHEET

CLIENT: EG&G	FILE NO.: 2K68	BY: M. Speranza	PAGE 3 OF
SUBJECT: Pond 207C Waste Loading		CHECKED BY: [initials]	DATE: 5/19/92

Batches 12 – 16 (Mixed Date 4/2/92)

Total Solids = 38.6% – Based on laboratory analysis
See laboratory Notebook 15 pg. Book No P109-92

Total Dissolved Solids = 34.96% Assummed Specific Gravity of 1.373 from the following

TS = 530,000 mg/L } see laboratory analysis sheet
TDS = 480,000 mg/L } Laboratory No. – PO195049

$\therefore$ SG = 530,000/386,000 = 1.373

TDS = 480,000/1.373 = 34.96%

Total ~~Dissolved~~ suspended Solids = 9.1% – Based on Laborotory analysis
See Laboratory Notebook 22 pg
Book No P109-92, Submission #2.

Batches 17 and 18 (mixed Date 4/2/92)

These batches were prepared by heating a slurry of Pond 207C to 70°F. The slurry had a TS = 38.6%, TDS = 34.96%, and a TSS = 9.1% with excess crystal. As the temperature increased the crystal dissolved causing an increase in TS and TDS.

TS = 44.0% – based on laboratory analysis
See Laboratory Notebook 19 pg Book No P109-92

TDS = 40.4% – calculated by the following:
Difference in TS of heated slurry – nonheated slurry
44% – 38.6 = 5.4%
This increase is contributed from dissolved crystal since no addition solids were added.

HALLIBURTON NUS Environmental Corporation and Subsidiaries			STANDARD CALCULATION SHEET
CLIENT: EG&G	FILE NO.: 2K68	BY: M Speranza	PAGE 4 OF 4
SUBJECT: 207C Waste Loadings		CHECKED BY: RS	DATE: 4/19/92

∴ TDS = 34.96 + 5.4 = 40.4%

TSS = 9.1% same as TSS for Batches 12-16

Batches 19-21 (mix Date - 4/3/92)

TS = 43.4% - based on laboratory analysis
See laboratory Notebook 23 pg Book No P109-92

TDS = 32.1% - No data available from analysis
approximated by subtracting TS-TSS
TDS = 43.4 - 11.3 = 32.1%

TSS = 11.3% - based on laboratory analysis
See Laboratory Notebook 23 pg
Book No P109-92.

Batches 22-24 (mix date - 4/3/92)

TS = 49.1% - based on laboratory analysis
See Laboratory Notebook 23 pg Book No P109-92

TDS = 31.9% - No data available from analysis
approximated by subtracting TS-TSS
TDS = 49.1 - 17.2 = 31.9%

TSS = 17.2% - based on laboratory analysis
See Laboratory Notebook 23 pg. Book No P109-92

HALLIBURTON NUS Environmental Corporation and Subsidiaries — STANDARD CALCULATION SHEET

CLIENT: EG&G	FILE NO.: 2K68	BY: Mark Speranza	PAGE 1 OF
SUBJECT: Pond 207C and Clarifier Waste Loading		CHECKED BY: JCE	DATE: 5/19/92

Waste loadings for Combined Waste Stream of Pond 207C and Clarifier – Supporting information for Table 2-2

Batches 1C – 3C (mix date – 4/1/92)

TS = 33.8 – based on laboratory analysis
See Laboratory Notebook 7 pg Book No P109-92

TDS = 27.3% – Calculated by the following:

This mixture was prepared using 25% by weight clarifier sludge with 16.1% TSS, 5.9% TDS, and 17.7% TS, and 75% by weight of 207C Slurry with 9.3% TSS, 34.96% TDS, and 38.6% TS

$$\therefore TDS = .3496(.75) + (1-.177)(.25)(.059) = 27.4\%$$

TSS = 11% calculated by the following:

$$.75(.3496) + .25(.161) = 11.0\%$$

HALLIBURTON NUS Environmental Corporation and Subsidiaries — *STANDARD CALCULATION SHEET*

CLIENT: EG&G	FILE NO.: 2K68	BY: M Speranza	PAGE 2 OF
SUBJECT: Waste Loading for 207C + Clarifier		CHECKED BY: DS	DATE:

Batches 4C — 14C (Date mixed 4/6/92)

TS = 38.9% – based on laboratory analysis
See Laboratory Notebook 37 pg Book No. P109-92

TDS = 34.6 – Assume Specific gravity = 1.33
TDS = 460,000 mg/l from Laboratory Analysis Sheet – Laboratory No. = P0195067

TDS = 460,000/1.33 = 34.6%

TSS = 11.6% – based on laboratory analysis
See Laboratory Notebook 39 pg Book No. P109-92

CLIENT ORIGINAL

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April 18, 1992
Report No.: 00007227
Section A Page 2

LABORATORY ANALYSIS REPORT

CLIENT NAME: ROCKY FLATS - C/O NUS CORPORATION
ADDRESS: 661 ANDERSEN DRIVE
PITTSBURGH, PA 15220-
ATTENTION: MR. RICH NINESTEEL

NUS CLIENT NO: 1431 0004
WORK ORDER NO: 2K68
VENDOR NO:

Carbon Copy:

SAMPLE ID: 207C WATER & CLARIFIER SLUDGE A
NUS SAMPLE NO: P0195067
P.O. NO.:

DATE SAMPLED: 06-APR-92
DATE RECEIVED: 06-APR-92
APPROVED BY: R Volk

LN	TEST CODE	DETERMINATION	RESULT	UNITS
1	I590	Solids, Dissolved at 180C	460000	mg/L
2	I620	Solids, Total at 103C	38.7	%

COMMENTS:

HALLIBURTON NUS Environmental Corporation and Subsidiaries | STANDARD CALCULATION SHEET

CLIENT: EG&G	FILE NO.: 2K68	BY: M Speranza	PAGE OF
SUBJECT: Waste Loading For Latex Mixes		CHECKED BY:	DATE: 4/19/92

Pond 207C w/ Latex 2000

The waste loadings for these Batches (1L - 19L) coorrelate with the corresponding Batches without latex (Batches 1-24) - for back-up information see sheets to

Batches Without Latex	Batches With Latex
1-5	1L-9L
12-16	10L-14L
9-11	15L and 16L
20	17L
22-24	18L and 19L

Pond 207C and Clarifier w/ Latex 2000

The waste loadings for these Batches (1CL-5CL) Coorelate with the cooresponding Batches without latex (Batches 1C-14C) - for back-up information see sheets to .

Batches Without Latex	Batches with Latex
4C-14C	1CL-5CL

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March 11, 1992
Report No.: 00006289
Section A Page 4

LABORATORY ANALYSIS REPORT

CLIENT NAME: ROCKY FLATS - C/O NUS CORPORATION
ADDRESS: 661 ANDERSEN DRIVE
PITTSBURGH, PA 15220-
ATTENTION: MR. RICH NINESTEEL

NUS CLIENT NO: 1431 0004
WORK ORDER NO: 2K68
VENDOR NO:

Carbon Copy:

SAMPLE ID: 207C FILTRATE
NUS SAMPLE NO: P0190478
P.O. NO.:

DATE SAMPLED: 21-FEB-92
DATE RECEIVED: 21-FEB-92
APPROVED BY: J Simanic

LN	TEST CODE	DETERMINATION	RESULT	UNITS
1	I590	Solids, Dissolved at 180C	358,000	mg/L

COMMENTS:

CLIENT ORIGINAL

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Cleveland, OH 44130
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April 14, 1992
Report No.: 00007097
Section A Page 4

LABORATORY ANALYSIS REPORT

CLIENT NAME: ROCKY FLATS - C/O NUS CORPORATION
ADDRESS: 661 ANDERSEN DRIVE
PITTSBURGH, PA 15220-
ATTENTION: MR. RICH NINESTEEL

NUS CLIENT NO: 1431 0004
WORK ORDER NO: 2K68
VENDOR NO:

Carbon Copy:

SAMPLE ID: 207C WATER SETTLED #1
NUS SAMPLE NO: P0195050
P.O. NO.:

DATE SAMPLED: 03-APR-92
DATE RECEIVED: 04-APR-92
APPROVED BY: J Simanic

LN	TEST CODE	DETERMINATION	RESULT	UNITS
1	I590	Solids, Dissolved at 180C	450000	mg/L
2	I620	Solids, Total at 103C	510000	mg/L

COMMENTS:

HALLIBURTON NUS Environmental Corporation and Subsidiaries — *STANDARD CALCULATION SHEET*

CLIENT: EG&G	FILE NO.: 2K68	BY: M Speranza	PAGE 1 OF 3
SUBJECT: Clarifier and 207C Waste Stream		CHECKED BY: [illegible]	DATE: 3/19/91

Loading of Clarifier and Pond 207C

1. Batches 1C to 3C

- % Clarifier by weight

500g of Clarifier Sludge + 1500 g of 207C Slurry

∴ 500g / 2000g = **25% by wt** ✓

- % Clarifier by Volume

S.G. of Clarifier Solids = 2.74 – see LIMs report – P0193462
Total Solids of Clarifier Sample = 17.7% – " " " " "
S.G of Clarifier Water = 1.04 – Characterization Report

$$\text{S.G. of Clarifier Slurry} = \left[{.177}/{2.74} + {.823}/{1.04} \right]^{-1} = 1.17$$

(Salt Rinse) S.G. of 207C sludge solids → 2.41, 2.27, 2.31, 1.93
Avg = 2.23
S.G. of 207C Water → 1.332 Avg. Characterization report
TSS of 207C Slurry = 9.3%

$$\text{S.G. of 207C Slurry} = \left[{.093}/{2.23} + \frac{.907}{1.332} \right]^{-1} = 1.38$$

$$\therefore \frac{500/1.17}{\left(\frac{500}{1.17} + \frac{1500}{1.38}\right)} = \underline{28.2\% \text{ by Vol.}}$$

HALLIBURTON NUS Environmental Corporation and Subsidiaries			*STANDARD CALCULATION SHEET*
CLIENT: EG&G	FILE NO.: 2K68	BY: M Speranza	PAGE 2 OF 3
SUBJECT: Clarifier and 207C Waste Stream		CHECKED BY: AS	DATE: 5/19/93

– % Clarifier Solids by weight

$$\text{total Solids} = \frac{500g\,(.177)}{.40\,(1500) + .177\,(500)} = .128 = 12.8\%$$

$$TSS = 500(.177) / [.093\,(1500) + .177\,(500)] = .39 = 39\%$$

2. Batches 4C to 14C

– % Clarifier by weight

% Solids clarifier = 24.6 LIMS Report – P0194245
S.G. Solids = 2.74

$$\text{S.G. Clarifier Slurry} = \left[\left(\frac{.246}{2.74}\right) + \left(.754/1.04\right)\right]^{-1} = 1.24$$

2 l of clarifier slurry mixed with 6 l of 207C slurry 9.3% TSS with S.G of 1.312. This was then diluted with 7.5L 207C water with S.G. of 1.321 (calculated on pg 1 of 3)

$$\frac{2L\,(1.17)}{2(1.17) + 6(1.312) + 7.5\,(1.321)} = \underline{11.6\%\text{ by Wt}}$$

HALLIBURTON NUS Environmental Corporation and Subsidiaries			*STANDARD CALCULATION SHEET*
CLIENT: EG&G	FILE NO.: 2K68	BY: M Speranza	PAGE 3 OF 3
SUBJECT: Clarifier and 207C Waste Stream		CHECKED BY:	DATE: 5/19/92

- % Clarifier by Volume

$$\frac{2l}{2l + 6l + 7.5l} = \underline{12.9\% \text{ by Vol.}}$$

- % Clarifier solids by weight

Assume: SG = 1.34 for 40% TS
SG = 1.32 for 38.6% TS

$$\text{total Solids} = \frac{2l(.246)(2.74)}{\underbrace{2l(.246)(2.74)}_{\text{clarifier}} + \underbrace{6l(.403)(1.348)}_{\text{207C slurry}} + \underbrace{7.5(.386)(1.32)}_{\text{WATER}}}$$

$$= \underline{16.1\% \text{ by Clarifier Solids wt}}$$

$$TSS = \frac{2l(.246)(2.74)}{2l(.246)(2.74) + 6l(.093)(2.23) + 7.5(.009)(2.23)} = .49 = 49\%$$

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April 14, 1992
Report No.: 00007097
Section A Page 4

LABORATORY ANALYSIS REPORT

CLIENT NAME: ROCKY FLATS - C/O NUS CORPORATION
ADDRESS: 661 ANDERSEN DRIVE
PITTSBURGH, PA 15220-
ATTENTION: MR. RICH NINESTEEL

NUS CLIENT NO: 1431 0004
WORK ORDER NO: 2K68
VENDOR NO:

Carbon Copy:

SAMPLE ID: 207C WATER SETTLED #1
NUS SAMPLE NO: P0195050
P.O. NO.:

DATE SAMPLED: 03-APR-92
DATE RECEIVED: 04-APR-92
APPROVED BY: J Simanic

LN	TEST CODE	DETERMINATION	RESULT	UNITS
1	I590	Solids, Dissolved at 180C	450000	mg/L
2	I620	Solids, Total at 103C	510000	mg/L

COMMENTS:

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March 11, 1992
Report No.: 00006289
Section A Page 3

LABORATORY ANALYSIS REPORT

CLIENT NAME: ROCKY FLATS - C/O NUS CORPORATION
ADDRESS: 661 ANDERSEN DRIVE
PITTSBURGH, PA 15220-
ATTENTION: MR. RICH NINESTEEL

NUS CLIENT NO: 1431 0004
WORK ORDER NO: 2K68
VENDOR NO:

Carbon Copy:

SAMPLE ID: 207C FILTERCAKE
NUS SAMPLE NO: P0190477
P.O. NO.:

DATE SAMPLED: 21-FEB-92
DATE RECEIVED: 21-FEB-92
APPROVED BY: J Simanic

LN	TEST CODE	DETERMINATION	RESULT	UNITS
2	T71W	Specific Gravity by Hydrometer	1.312	
3	S909	Buchner Funnel Filtration	3.0	%

COMMENTS:

CLIENT DUPLICATE

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April 14, 1992
Report No.: 00007097
Section A Page 3

LABORATORY ANALYSIS REPORT

CLIENT NAME: ROCKY FLATS - C/O NUS CORPORATION
ADDRESS: 661 ANDERSEN DRIVE
PITTSBURGH, PA 15220-
ATTENTION: MR. RICH NINESTEEL

NUS CLIENT NO: 1431 0004
WORK ORDER NO: 2K68
VENDOR NO:

Carbon Copy:

SAMPLE ID: 207C WATER MIXED UP #2
NUS SAMPLE NO: P0195049
P.O. NO.:

DATE SAMPLED: 03-APR-92
DATE RECEIVED: 04-APR-92
APPROVED BY: J Simanic

LN	TEST CODE	DETERMINATION	RESULT	UNITS
1	I590	Solids, Dissolved at 180C	480000	mg/L
2	I620	Solids, Total at 103C	530000	mg/L

COMMENTS:

0.9
0.9
0.9

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April 14, 1992
Report No.: 00007097
Section A Page 3

LABORATORY ANALYSIS REPORT

CLIENT NAME: ROCKY FLATS - C/O NUS CORPORATION
ADDRESS: 661 ANDERSEN DRIVE
PITTSBURGH, PA 15220-
ATTENTION: MR. RICH NINESTEEL

NUS CLIENT NO: 1431 0004
WORK ORDER NO: 2K68
VENDOR NO:

Carbon Copy:

SAMPLE ID: 207C WATER MIXED UP #2
NUS SAMPLE NO: P0195049
P.O. NO.:

DATE SAMPLED: 03-APR-92
DATE RECEIVED: 04-APR-92
APPROVED BY: J Simanic

LN	TEST CODE	DETERMINATION	RESULT	UNITS
1	I590	Solids, Dissolved at 180C	480000	mg/L
2	I620	Solids, Total at 103C	530000	mg/L

COMMENTS:

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March 11, 1992
Report No.: 00006289
Section A Page 3

LABORATORY ANALYSIS REPORT

CLIENT NAME: ROCKY FLATS - C/O NUS CORPORATION
ADDRESS: 661 ANDERSEN DRIVE
PITTSBURGH, PA 15220-
ATTENTION: MR. RICH NINESTEEL

Carbon Copy:

NUS CLIENT NO: 1431 0004
WORK ORDER NO: 2K68
VENDOR NO:

SAMPLE ID: 207C FILTERCAKE
NUS SAMPLE NO: P0190477
P.O. NO.:

DATE SAMPLED: 21-FEB-92
DATE RECEIVED: 21-FEB-92
APPROVED BY: J Simanic

LN	TEST CODE	DETERMINATION	RESULT	UNITS
2	T71W	Specific Gravity by Hydrometer	1.312	
3	S909	Buchner Funnel Filtration	3.0	%

COMMENTS:

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May 12, 1992
Report No.: 00007742
Section A Page 4

LABORATORY ANALYSIS REPORT

CLIENT NAME: ROCKY FLATS - C/O NUS CORPORATION
ADDRESS: 661 ANDERSEN DRIVE
PITTSBURGH, PA 15220-
ATTENTION: MR. RICH NINESTEEL

NUS CLIENT NO: 1431 0004
WORK ORDER NO: 2K68
VENDOR NO:

Carbon Copy:

SAMPLE ID: CLARIFIER SLUDGE
NUS SAMPLE NO: P0194245
P.O. NO.:

DATE SAMPLED: UnAvail
DATE RECEIVED: 30-MAR-92
APPROVED BY: J Simanic

LN	TEST CODE	DETERMINATION	RESULT	UNITS
1	I620S	Percent Solids at 103C	24.6	%
2	T70	Specific gravity f-grn	2.74	

COMMENTS:

CLIENT ORIGINAL

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April 24, 1992
Report No.: 00007348
Section A Page 1

LABORATORY ANALYSIS REPORT

CLIENT NAME: ROCKY FLATS - C/O NUS CORPORATION
ADDRESS: 661 ANDERSEN DRIVE
PITTSBURGH, PA 15220-
ATTENTION: MR. RICH NINESTEEL

NUS CLIENT NO: 1431 0004
WORK ORDER NO: 2K68
VENDOR NO:

Carbon Copy:

SAMPLE ID: CLARIFIER
NUS SAMPLE NO: P0193462
P.O. NO.:

DATE SAMPLED: UnAvail
DATE RECEIVED: 23-MAR-92
APPROVED BY: J Simanic

LN	TEST CODE	DETERMINATION	RESULT	UNIT
1	I620S	Percent Solids at 103C	17.7	%
2	T70	Specific gravity f-grn	2.74	

COMMENTS:

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CLIENT ORIGINAL

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Cleveland, OH 44130
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May 12, 1992
Report No.: 00007742

LABORATORY ANALYSIS REPORT

CLIENT NAME: ROCKY FLATS - C/O NUS CORPORATION
ADDRESS: 661 ANDERSEN DRIVE
PITTSBURGH, PA 15220-
ATTENTION: MR. RICH NINESTEEL

NUS CLIENT NO: 1431 0004
WORK ORDER NO: 2K68
VENDOR NO:

Carbon Copy:

SAMPLE ID: 207C CRYSTALS
NUS SAMPLE NO: P0194247
P.O. NO.:

DATE SAMPLED: UnAvail
DATE RECEIVED: 30-MAR-92
APPROVED BY: J Simanic

LN	TEST CODE	DETERMINATION	RESULT	UNITS
1	S088	Bulk Density on Waste	1.75	*

COMMENTS: * Result should be expressed as specific gravity.

TABLE 6

GEOTECHNICAL DATA - MODIFIED METHOD

POND 207C

	NORTH WEST	SOUTH WEST	SOUTH EAST	NORTH EAST
<u>FILTERCAKE</u>				
Specific Gravity	2.92(1)	2.84	2.87	2.82
Specific Gravity (Salt Rinsed)	2.41	2.27 2	2.31 3	1.93 ok
Viscosity (CP)	1660	600(2)	INT(3)	INT(3) 3
Percent Water (Karl Fisher)	41.1	40.1	30.7	24.9
Percent Solids (Filtercake)	29.5	33.7	40.8	56.1
Grain Size (% passing sieve)				
Sieve 3/8 inch	100	100	100	100
Sieve No. 4	94.9	97.5	98.4	95.1
Sieve No. 10	58.6	71.6	76.3	67.2
Sieve No. 20	32.9	42.5	48.8	39.7
Sieve No. 50	14.6	19.9	23.9	17.2
Sieve No. 100	7.9	10.7	13.4	10.0
Sieve No. 200	3.5	4.2	5.7	4.1
<u>FILTRATE</u>				
Specific Gravity (Hydrometer)	1.402	1.404	1.404	1.418
Solids Dissolved (180°C), mg/L	640,00	620,000	630,000	630,000
pH	10.6	10.7	10.5	10.5
<u>PYCNOMETER FILTRATE</u>				
Specific Gravity (Hydrometer)	1.062	1.067	1.077	1.082
Solids Dissolved (180°C), mg/L	88,000	82,000	100,000	100,000
pH	10.3	10.6	10.7	10.7
<u>SALT RINSE FILTRATE</u>				
Specific Gravity (Hydrometer)	1.102	1.102	1.117	1.122
Solids Dissolved (180°C), mg/L	130,000	120,000	150,000	160,000
pH	10.1	10.5	10.6	10.6

Source: Testing was performed at HALLIBURTON NUS Pittsburgh Laboratory as per Brown & Root's Guidelines for Data Testing.

(1) Dried at 110 degrees Celcius.

(2) Encountered some interference with crystal formation.

3 (3) Interference - unable to conduct test due to sample matrix, i.e...crystal formation.

ATTACHMENT E

AIR SHIPMENT OF STABILIZED WASTE SAMPLES

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

TO: **TOM SNARE** **June 11, 1992**

FROM: **DAVID YESSO**

SUBJECT: **AIR SHIPMENT OF RFP SAMPLES**

After again reviewing the data we have available on the materials we will be solidifying at the Rocky Flats Plant, I now believe that there are no regulatory issues that would prohibit the shipment of solidified waste samples by air. In your memo of April 9,1992 (C-49-04-92-71) you calculated the maximum concentrations of plutonium that would be expected in the various solidified wastes, and I understand from our conversation that a typical sample would be a small cylinder of solidified material weighing approximately 500 grams. Using this weight and the maximum calculated concentration of the plutonium in the samples (2.87 nCi/g for the 207C/Clarifier solidified wastes), it can be calculated that each cylinder should have a maximum plutonium content of 1435 nCi. This is only 0.07 percent of the 2E06 nCi(2 mCi) package limit for the shipment of plutonium by air, using a Type A container. Consequently, there would be no regulatory restriction to shipment of any of the solidified waste samples. The Type A containers are not anything particularly unusual, are readily available commercially, and I would imagine that they are also used frequently at the RFP. Since I understand that there will only be about 16 samples that will need to be shipped to the HNUS Laboratory, obtaining enough containers should not be difficult for EG&G even if they shipped only one sample at a time.

The RFP samples received at HNUS were designated by RFP as containing <2nCi/g or <260 nCi/g depending upon the source of the material. Since the RFP Traffic Department approved these shipments, it may be concluded that the data used to arrive at these activity concentrations were considered acceptable for shipping purposes. Consequently, it seems reasonable that the same data could be used to calculate the maximum concentration in the solidified wastes samples. Even if it were assumed that each sample were undiluted and contained 260 nCi/g of plutonium rather than the estimated 2.87 nCi/g, a 500 gram cylinder would contain only 130,000 nCi of plutonium or about 7 percent of the air shipment limit.

I recommend that we propose to RFP that the maximum plutonium content in the solidified waste samples be estimated on the basis of the highest observed levels of plutonium in the pond and clarifier solids, and the known dilution caused by the addition of the cement and flyash, and the average weight of the samples prepared during the treatability studies. This data should then be presented to the RFP Traffic Department to demonstrate that the shipment of the samples in Type A containers is consistent with DOE and DOT transportation requirements.

I have reviewed NRC, DOT, and DOE shipping requirements, and I am confident that there are no restrictions on shipping the material as I have outlined above. However, I do not have access to the RFP internal policies or procedures, so there still remains a possibility that there are some RFP-specific policies that would prohibit the shipment. In that case, the regulations themselves are of no consequence and the RFP requirements would take precedence.

HALLIBURTON NUS
Environmental Corporation

INTERNAL CORRESPONDENCE

C-49-04-92-71

TO: ARNIE ALLEN

DATE: APRIL 9, 1992

FROM: TOM SNARE TLS

cc: DISTRIBUTION

SUBJECT: RADIOACTIVE NUCLEI LIMIT CALCULATIONS FOR AIR SHIPMENT OF SOLIDIFIED WASTE SAMPLES FROM ROCKY FLATS

The attached calculations determine the feasibility of shipping solidified waste samples from EG&G ROCKY FLATS to the HNUS Laboratory in Pittsburgh for testing. These calculations cover Federal NRC/DOT air shipment limitations and do not include any EG&G or DOE specific restrictions which may be more restrictive. The applicable regulations in 10 CFR part 71 and 49 CFR part 173 have been included. The anticipated laboratory testing requirement is 350g per sample, which is the approximate weight of one 2-inch diameter, 4-inch high cylinder.

Although the calculations provide a general indication of compliance with the regulations, the actual material being shipped must be analyzed prior to shipment. The calculations indicate the following:

1. The solidified material from the 207A/B process can be shipped by air with no restrictions.

2. The solidified material from the 207C/Clarifier process can be shipped by air as limited quantity radioactive material (if the mass is less than $10^{-3} \times A_2$) or in a Type A package with appropriate labelling (if the mass is greater than $10^{-3} \times A_2$, but less than A_2). Based on the attached calculations, an individual cylinder should be less than $10^{-3} \times A_2$.

Figure 1-1 defines the identification, packaging, and shipping requirements for waste containing Plutonium. The logic diagram does not consider requirements for shipment of hazardous waste.

/tls

Distribution:

Rich Ninesteel
John Schmidt
Ted Bittner
Don Brenneman
Dave Yesso
Shaj Mathew
File 2K68

ACAD: 2K68\LOGIC.DWG LIMITS 04/08/92 MJJ

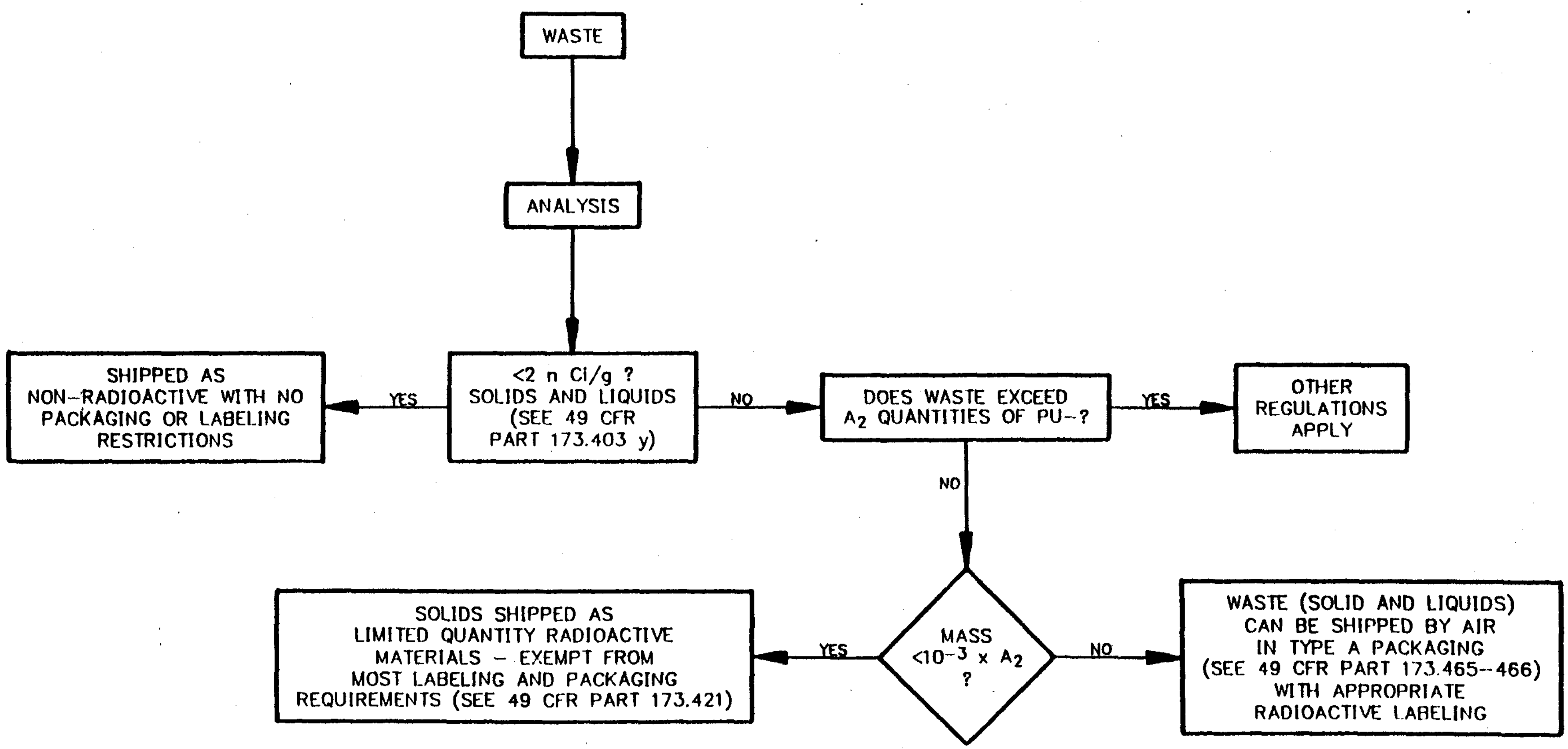

FIGURE 1 -1

LOGIC FLOW DIAGRAM
ROCKY FLATS, GOLDEN, COLORADO

HALLIBURTON NUS
Environmental Corporation

HALLIBURTON NUS Environmental Corporation and Subsidiaries			STANDARD CALCULATION SHEET
CLIENT: EG&G	FILE NO.: 2K68.232	BY: TLS	PAGE 1 OF 3
SUBJECT: Activity limits on Air shipment		CHECKED BY:	DATE: 4/7/92

Pu - Air Shipment Activity concentration limit as specified in 10 CFR.71 = < 2 nCi/g

Results (Dry weight basis)

Pond Sludge	PU-239, 240	gross β	Total
207A	0.072 nCi/g	0.095 nCi/g	0.167 nCi/g
207B (comb)	0.023 nCi/g	0.024 nCi/g	0.047 nCi/g
207C	0.016 nCi/g	0.710 nCi/g	0.726 nCi/g
Clarifier	80 nCi/g	0.695 nCi/g	80.7 nCi/g

PU-239, 240 Results from Weston - Teledyne data, these are maximum observed value
gross β Results from Pond Sludge / Clarifier Sludge Characterization Report

For 207A / 207B solidified material:

Assumptions:
1) gross β result is equal to Pu-241
2) No PU-242 exist in waste
3) 20% Solids to be solidified
4) 1.5 = mass Dilution Factor due to the addition of cement and flyash

207A:

$$(0.167\ nCi/g)(0.20)\left(\frac{1}{1.5}\right) = 0.0223\ nCi/g$$ in final product

207B: = 0.00627 nCi/g in final product

HALLIBURTON NUS Environmental Corporation and Subsidiaries			STANDARD CALCULATION SHEET
CLIENT: EG&G	FILE NO.: 2K68.232	BY: TLS	PAGE 2 OF 3
SUBJECT: Activity limits on Air Shipment		CHECKED BY: RMM	DATE: 4/7/92

thus the final solidified product from 207A and 207B sludges can be shipped via Air

For 207C and Clarifier solidified material:

Assumptions:
1) gross β result is equal to PU-241
2) No PU-242 exist in the waste
3) entire contents to be solidified @ 25% Clarifier and 75% 207C
4) 1.5 = mass Dilution factor due to the addition of cement and flyash
5) % solids ⇒ 207C sludge = 11.6%
   Clarifier sludge = 21%
6) Negligible contribution from water

$$\frac{[(0.726\ ^{nCi}/g)(0.116)]\,0.75 + [(80.7)(0.21)]\,0.25}{1.0} \times \frac{1}{1.5} = 2.87\ ^{nCi}/g \text{ in final product}$$

This exceeds the activity concentration for shipment of PU-material. However, this can be shipped via Air with no more than an A_2 quantity per isotope in a single package.

Limits: $<$ 2 mCi PU (239, 240) / package
& $<$ 100 mCi PU (241) / package

quantity limit for PU (239, 240):

$$\frac{[(0.016\ ^{nCi}/g)(0.116)]\,0.75 + [(80\ ^{nCi}/g)(0.21)]\,0.25}{1.0} \times \frac{1}{1.5} = 2.80\ ^{nCi}/g \text{ PU-239,240}$$

$$2 \times 10^6 \text{ nCi PU(239,240)} \times \frac{1}{2.80\ ^{nCi}/g \text{ PU(239,240)}} \times 0.75 = 536000\text{ g} = 536 \text{ kg/package}$$

includes 25% safety factor

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SUBJECT: Activity limits on Air Shipment		CHECKED BY:	DATE: 4/7/92

quantity limit for PU-241:

$$\frac{[(0.710)(0.116)]0.75 + [(0.695)(0.21)]0.25}{1.0} \times \frac{1}{1.5} = 0.0655 \ nCi/g \ PU\text{-}241$$

$$1 \times 10^{8} \ nCi \ PU\text{-}241 \times \frac{1}{0.0655 \ nCi/g \ PU\text{-}241} \times 0.75 = 153 \times 10^{7} g$$
$$= 153 \times 10^{4} \ kg/package$$

The limiting quantity is from the PU-239,240 contribution at 536 kg per package of solidified material. Using this limit requires Type A packaging and can be shipped via air.

For air shipment of this material (solid) as a "Limited quantity of radioactive material" as specified in 49 CFR part 173.421, the weight per package limit would be $10^{-3} A_2$.

$$\frac{536 \ kg}{1000} = 0.536 \ kg/package$$
$$= 536 \ g/package$$

This quantity per package limit requires less restrictive packaging and labeling requirements.

aged over the surface wiped, must not exceed the limits given in Table V of this part at any time during transport. Other methods of assessment of equal or greater efficiency may be used. When other methods are used, the detection efficiency of the method used must be taken into account and in no case may the non-fixed contamination on the external surfaces of the package exceed ten times the limits listed in Table V.

TABLE V—REMOVABLE EXTERNAL RADIOACTIVE CONTAMINATION WIPE LIMITS

Contaminent	Maximum permissible limits	
	$\mu Ci/cm^2$	dpm/cm^2
Beta-gamma emitting radionuclides; all radionuclides with half-lives less than ten days; natural uranium; natural thorium; uranium-235; uranium-238; thorium-232; thorium-228 and thorium-230 when contained in ores or physical concentrates	10 [illegible]	22
All other alpha emitting radionuclides	10 [illegible]	2.2

(2) In the case of packages transported as exclusive use shipments by rail or highway only, the non-fixed radioactive contamination at any time during transport must not exceed ten times the levels prescribed in paragraph (i)(1) of this section. The levels at the beginning of transport must not exceed the levels prescribed in paragraph (i)(1) of this section:

(j) External radiation levels around the package and around the vehicle, if applicable, will not exceed the limits specified in § 71.47 at any time during transportation; and

(k) Accessible package surface temperatures will not exceed the limits specified in § 71.43(g) at any time during transportation.

[48 FR 35607, Aug. 5, 1983; 48 FR 38450, Aug. 24, 1983]

§ 71.88 Air transport of plutonium.

(a) Notwithstanding the provisions of any general licenses and notwithstanding any exemptions stated directly in this part or included indirectly by citation of 49 CFR Chapter 1, as may be applicable, the licensee shall assure that plutonium in any form, whether for import, export, or domestic shipment, is not transported by air or delivered to a carrier for air transport unless:

(1) The plutonium is contained in a medical device designed for individual human application; or

(2) The plutonium is contained in a material in which the specific activity is not greater than 0.002 microcuries per gram of material and in which the radioactivity is essentially uniformly distributed; or

(3) The plutonium is shipped in a single package containing no more than an A_2 quantity of plutonium in any isotope or form and is shipped in accordance with § 71.5 of this part; or

(4) The plutonium is shipped in a package specifically authorized for the shipment of plutonium by air in the Certificate of Compliance for that package issued by the Commission.

(b) Nothing in paragraph (a) of this section is to be interpreted as removing or diminishing the requirements of § 73.24 of this chapter.

(c) There have been two orders issued by the NRC restricting the air shipment of plutonium in accordance with Pub. L. 94-79. The first order, issued on August 15, 1975 was superseded by the second order dated September 1, 1978, which has remained in effect since that time. As of the effective date of this rule, the outstanding order dated September 1, 1978 is revoked.

§ 71.89 Opening instructions.

Prior to delivery of a package to a carrier for transport, the licensee shall ensure that any special instructions needed to safely open the package have been sent to or otherwise made available to the consignee for the consignee's use in accordance with § 20.205 of this chapter.

§ 71.91 Records.

(a) Each licensee shall maintain for a period of three years after shipment a record of each shipment of licensed material not exempt under § 71.10, showing, where applicable:

(1) Identification of the packaging by model number;

TABLE A-1—A_1 AND A_2 VALUES FOR RADIONUCLIDES—Continued

(See footnotes at end of Table A-1)

Symbol of radionuclide	Element and atomic number	A_1(Ci)	A_2(Ci)	Specific activity (Ci/g)
142_{Pr}	Praseodymium (59)	10	10	1.2×10^4
143_{Pr}		300	20	6.6×10^4
191_{Pt}	Platinum (78)	100	100	2.3×10^5
$193m_{Pt}$		200	200	2.0×10^5
$197m_{Pt}$		300	20	1.2×10^7
197_{Pt}		300	20	8.8×10^5
238_{Pu}	Plutonium (94)	3	0.003	1.7×10
239_{Pu}		2	0.002	6.2×10^{-2}
240_{Pu}		2	0.002	2.3×10^{-1}
241_{Pu}		1000	0.1	1.1×10^2
242_{Pu}		3	0.003	3.9×10^{-3}
223_{Ra}	Radium (88)	50	0.2	5.0×10^4
224_{Ra}		6	0.5	1.6×10^5
226_{Ra}		10	0.05	1.0
228_{Ra}		10	0.05	2.3×10^2
81_{Rb}	Rubidium (37)	30	25	8.2×10^6
86_{Rb}		30	30	8.1×10^4
87_{Rb}		Unlimited.	Unlimited.	6.6×10^{-8}
$_{Rb}$ (natural)		Unlimited.	Unlimited.	1.8×10^{-8}
186_{Re}	Rhenium (75)	100	20	1.9×10^5
187_{Re}		Unlimited.	Unlimited.	3.8×10^{-8}
188_{Re}		10	10	1.0×10^6
$_{Re}$ (natural)		Unlimited.	Unlimited.	2.4×10^{-8}
$103m_{Rh}$	Rhodium (45)	1000	1000	3.2×10^7
105_{Rh}		200	25	8.2×10^5
222_{Rn}	Radon (86)	10	2	1.5×10^5
97_{Ru}	Ruthenium (44)	80	80	5.5×10^5
103_{Ru}		30	25	3.2×10^4
105_{Ru}		20	20	6.6×10^6
106_{Ru}		10	7	3.4×10^3
35_{S}	Sulphur (16)	1000	60	4.3×10^4
122_{Sb}	Antimony (51)	30	30	3.9×10^5
124_{Sb}		5	5	1.8×10^4
125_{Sb}		40	25	1.4×10^3
46_{Sc}	Scandium (21)	8	8	3.4×10^4
47_{Sc}		200	20	8.2×10^5
48_{Sc}		5	5	1.5×10^6
75_{Se}	Selenium (34)	40	40	1.4×10^4
31_{Si}	Silicon (14)	100	20	3.9×10^7
147_{Sm}	Samarium (62)	Unlimited.	Unlimited.	$2.0 \times 10^{-}$[illegible]
151_{Sm}		1000	90	2.6×10
153_{Sm}		300	20	4.4×10^5
113_{Sn}	Tin (50)	60	60	1.0×10^4
$119m_{Sn}$		100	100	4.4×10^3
125_{Sn}		10	10	1.1×10^5
$85m_{Sr}$	Strontium (38)	80	80	3.2×10^7
85_{Sr}		30	30	2.4×10^4
$87m_{Sr}$		50	50	1.2×10^7
89_{Sr}		100	10	2.9×10^4
90_{Sr}		10	0.4	1.5×10^2
91_{Sr}		10	10	3.6×10^6

bution of thorium isotopes (essentially 100 weight percent thorium-232).

(q) "Natural uranium" means uranium with the naturally occuring distribution of uranium isotopes (approximately 0.711 weight percent uranium-235 and the remainder essentially uranium-238).

(r) "Non-fixed radioactive contamination" means radioactive contamination that can be readily removed from a surface by wiping with an absorbent material. Non-fixed (removable) radioactive contamination is not significant if it does not exceed the limits specified in § 173.443.

(s) "Normal form radioactive material" means radioactive material which has not been demonstrated to qualify as "special form radioactive material."

(t) "Package" means, for radioactive materials, the packaging together with its radioactive contents as presented for transport.

(u) "Packaging" means, for radioactive materials, the assembly of components necessary to ensure compliance with the packaging requirements of this subpart. It may consist of one or more receptacles, absorbent materials, spacing structures, thermal insulation, radiation shielding, and devices for cooling or absorbing mechanical shocks. The conveyance, tie-down system, and auxiliary equipment may sometimes be designated as part of the packaging.

(v) "Radiation level" means the radiation dose-equivalent rate expressed in millirem per hour (mrem/h). Neutron flux densities may be converted into radiation levels according to Table 1:

TABLE 1—NEUTRON FLUX DENSITIES TO BE REGARDED AS EQUIVALENT TO A RADIATION LEVEL OF 1 MILLIREM PER HOUR (MREM/H)[1]

Energy of neutron	Flux density equivalent to 1 mrem/h (Neutrons per square centimeter per second)(n/cm²/s)
Thermal	268.0
5 keV	228.0
20keV	112.0
100 keV	32.0
500 keV	12.0
1 MeV	7.2
5 MeV	7.2
10 MeV	6.8

[1] Flux densities equivalent for energies between those listed above may be obtained by linear interpolation.

(w) "Radioactive article" means any manufactured instruments and articles such as an instrument, clock, electronic tube or apparatus, or similar instruments and articles having radioactive material as a component part.

(x) "Radioactive contents" means the radioactive material, together with any contaminated liquids or gases, within the package.

(y) "Radioactive material" means any material having a specific activity greater than 0.002 microcuries per gram (uCi/g)(see definition of "specific activity").

(z) "Special form radioactive material" means radioactive material which satisfies the following conditions:

(1) It is either a single solid piece or is contained in a sealed capsule that can be opened only by destroying the capsule;

(2) The piece or capsule has at least one dimension not less than 5 millimeters (0.197 inch); and

(3) It satisfies the test requirements of § 173.469. Special form encapsulations designed in accordance with the requirements of § 173.389(g) in effect on June 30, 1983, and constructed prior to July 1, 1985 may continue to be used. Special form encapsulations either designed or constructed after June 30, 1985 must meet the requirements of this paragraph.

(aa) "Specific activity" of a radionuclide, means the activity of the radionuclide per unit mass of that nuclide. The specific activity of a material in which the radionuclide is essentially uniformly distributed is the activity per unit mass of the material.

subchapter, and which are not fissile materials and not in quantities exceeding A_2, shall be packed in suitable inside packagings of glass, metal or compatible plastic and suitably cushioned with a material which will not react with the contents. Inner packaging and cushioning shall be enclosed within an outside packaging of wood, metal, or plastic. The package shall be capable of meeting the applicable test requirements of § 173.465 without leakage of contents. For shipment by air, the maximum quantity in any package may not exceed 11.3 kilograms (25 pounds).

§ 173.420 Uranium hexafluoride (fissile and low specific activity).

(a) In addition to any other applicable requirements of this subchapter, uranium hexafluoride, fissile or low specific activity, shall be packaged in conformance with the following requirements:

(1) Before initial filling and during periodic inspection and test, packagings shall be cleaned in accordance with American National Standard N14.1.

(2) Packagings used for the transportation of uranium hexafluoride on or before June 30, 1987 are authorized for continued use until further notice. Packagings manufactured after June 30, 1987 shall be designed, fabricated, and marked in accordance with—

(i) American National Standard N14.1; or

(ii) Specifications for DOT Class 106A multi-unit tank car tanks (§§ 179.300, 179.301, and 179.302 of this subchapter).

(3) Uranium hexafluoride must be in solid form when offered for transportation;

(4) The volume of the solid uranium hexafluoride at 70° F must not exceed 61% of the volumetric capacity of the packaging; and,

(5) The pressure in the package at 70° F must be less than 14.8 psia.

(b) Packagings of uranium hexafluoride must be periodically inspected, tested and marked in accordance with American National Standard N14.1.

(c) Each repair to a packaging for uranium hexaflouride shall be performed in conformance with American National Standard N14.1.

[Amdt. 173-198, 51 FR 41633, Nov. 18, 1986, as amended at Amdt. 173-199, 52 FR 7582, Mar. 12, 1987; Amdt. 173-198, 52 FR 25341, July 6, 1987; Amdt. 173-206, 53 FR 36551, Sept. 20, 1988]

EFFECTIVE DATE NOTE: At 53 FR 36551, September 20, 1988, § 173.420, the term "N14.1-1982" was changed to "N14.1" in paragraphs (a)(1), (a)(2)(i), (b), and (c), effective April 1, 1989.

§ 173.421 Limited quantities of radioactive materials.

Radioactive materials whose activity per package does not exceed the limits specified in § 173.423 are excepted from the specification packaging, shipping paper and certification, marking, and labeling requirements of this subchapter and requirements of this subpart if:

(a) The materials are packaged in strong, tight packages that will not leak any of the radioactive materials during conditions normally incident to transportation;

(b) The radiation level at any point on the external surface of the package does not exceed 0.5 millirem per hour;

(c) The nonfixed (removable) radioactive surface contamination on the external surface of the package does not exceed the limits specified in § 173.443(a);

(d) The outside of the inner packaging or if there is no inner packaging, the outside of the packaging itself bears the marking "Radioactive";

(e) Except as provided in § 173.424, the package does not contain more than 15 grams of uranium-235; and

(f) The material is otherwise prepared for shipment as specified in § 173.421-1.

[Amdt. 173-162, 48 FR 10226, Mar. 10, 1983, as amended by Amdt. 173-167, 48 FR 30137, June 30, 1983]

§ 173.421-1 Additional requirements for excepted radioactive materials.

(a) Excepted radioactive materials prepared for shipment under the provisions of § 173.421, § 173.422, § 173.424, or § 173.427 must be certified as being acceptable for transportation by having a notice enclosed in or on the package, included with the packing list, or otherwise forwarded with the package. This notice must include the name of the consignor or consignee and the statement "This package conforms to the conditions and limitations specified in 49 CFR 173.421 for excepted radioactive material, limited quantity, n.o.s., UN2910; 49 CFR 173.422 for excepted radioactive material, instruments and articles, UN2911; 49 CFR 173.424 for excepted radioactive material, articles manufactured from natural *or* depleted uranium *or* natural thorium, UN2909; or 49 CFR 173.427 for excepted radioactive material, empty packages, UN2908", as appropriate.

(b) An excepted radioactive material classed radioactive material and prepared for shipment under the provisions of § 173.421, § 173.422, § 173.424, § 173.427 or § 173.421-2 is not subject to the requirements of this subchapter, except for:

(1) Sections 171.15, 171.16, 174.750, 176.710 and 177.861 of this subchapter pertaining to the reporting of incidents and decontamination when transported by a mode other than air; or

(2) Sections 171.15, 171.16, 175.45, and 175.700(b) of this subchapter pertaining to the reporting of incidents and decontamination if transported by aircraft. After May 2, 1989, it is also necessary to comply with §§ 173.448(f) and 175.700(c) of this subchapter.

(Approved by the Office of Management and Budget under control number 2137-0039)

[Amdt. 173-167, 48 FR 30137, June 30, 1983, as amended by Amdt. 173-187, 50 FR 18667, May 2, 1985; Amdt. 173-196, 51 FR 5973, Feb. 18, 1986; Amdt. 173-202, 52 FR 15949, May 1, 1987; Amdt. 173-204, 52 FR 36672, Sept. 30, 1987]

§ 173.421-2 Requirements for multiple hazard limited quantity radioactive materials.

(a) Except as provided in paragraph (b) of this section or in § 173.4 of this subchapter, when a limited quantity radioactive material meets the definition of another hazard class, it shall be:

(1) Classed for the additional hazard;

(2) Packaged to conform with requirements specified in § 173.421(a) through (e) or § 173.422(a) through (g), as appropriate; and

(3) Offered for transportation in accordance with requirements applicable to the hazard for which it is classed.

(b) When a limited quantity radioactive material meets the definition of an ORM-A, B, or C, or is a combustible liquid in a packaging having a rated capacity of 110 gallons or less, it shall be:

(1) Classed radioactive material if:

(i) The material is not a hazardous waste or hazardous substance; and

(ii) The material is offered for transportation in a mode to which requirements of this subchapter pertaining to the specific material and hazard class do not apply;

(2) Classed combustible liquid or ORM-A, B, or C, as appropriate, if:

(i) The material is a hazardous waste or hazardous substance; or

(ii) The material is offered for transportation in a mode to which requirements of this subchapter pertaining to the specific material and hazard class do apply;

(3) Packaged to conform with requirements specified in §§173.421(a) through (e) or 173.422(a) through (g), as appropriate; and

(4) Offered for transportation in accordance with requirements applicable to the hazard for which it is classed.

(c) A limited quantity radioactive material which is classed other than radioactive material under provisions of paragraphs (a) or (b) of this section is excepted from requirements of §§ 173.421-1(a), 172.203(d), and 172.204(c)(4) of this subchapter if the entry "Limited quantity radioactive material" appears on the shipping paper in association with the basic description.

(d) After May 2, 1989, a limited quantity radioactive material classed other than radioactive material may not be offered for transportation aboard a passenger-carrying aircraft unless that material is intended for use in, or incident to, research, medical diagnosis or treatment.

[Amdt. 173-167, 48 FR 30138, June 30, 1983, as amended by Amdt. 173-187, 50 FR 18668, May 2, 1985; Amdt. 173-202, 52 FR 15949, May 1, 1987]

§ 173.422 Exceptions for instruments and articles.

Instruments and manufactured articles (including clocks, electronic tubes or apparatus) or similar devices having radioactive materials in gaseous or non-dispersible solid form as a component part are excepted from the specification packaging, shipping paper and certification, marking and labeling requirements of this subchapter and requirements of this subpart, if:

(a) The activity of the instrument or article does not exceed the relevant limit listed in Table 7 in § 173.423;

(b) The total activity per package does not exceed the relevant limit listed in Table 7 in § 173.423;

(c) The radiation level at 10 centimeters (4 inches) from any point on the external surface of any unpackaged instrument or article does not exceed 10 millirem per hour;

(d) The radiation level at any point on the external surface of a package bearing the article or instrument does not exceed 0.5 millirem per hour, or, for exclusive use domestic shipments, 2 millirem per hour;

(e) The nonfixed (removable) radioactive surface contamination on the external surface of the package does not exceed the limits specified in § 173.443(a);

(f) Except as provided in § 173.424, the package does not contain more than 15 grams of uranium-235; and

(g) [Reserved]

(h) The instrument or article is otherwise prepared for shipment as specified in § 173.421-1.

[Amdt. 173-162, 48 FR 10226, Mar. 10, 1983, as amended by Amdt. 173-167, 48 FR 30138, June 30, 1983; Amdt. 173-162, 48 FR 31218, July 7, 1983; Amdt. 173-16, 48 FR 50460, Nov. 1, 1983]

§ 173.423 Table of activity limits—excepted quantities and articles.

The limits applicable to instruments, articles, and limited quantities subject to exceptions under §§ 173.421 and 173.422 are shown in Table 7:

TABLE 7—ACTIVITY LIMITS FOR LIMITED QUANTITIES, INSTRUMENTS, AND ARTICLES

Nature of contents	Instruments and articles		Materials package limits
	Instrument and article limits [1]	Package limits	
Solids:			
Special form	$10^{-2}A_1$	A_1	$10^{-3}A_1$.
Other forms	$10^{-2}A_2$	A_2	$10^{-3}A_2$.
Liquids:			
Tritiated water:			
<0.1 Ci/liter			1000 Curies.
0.1 Ci to 1.0 Ci/1			100 Curies.
>1.0 Ci/liter			1 Curie.
Other liquids	$10^{-3}A_2$	$10^{-1}A_2$	$10^{-4}A_2$.
Gases:			
Tritium [2]	20 Curies	200 Curies	20 Curies.
Special form	$10^{-3}A_1$	$10^{-2}A_1$	$10^{-3}A_1$
Other forms	$10^{-3}A_2$	$10^{-2}A_2$	$10^{-3}A_2$.

[1] For mixture of radionuclides see § 173.433(b).

[2] These values also apply to tritium in activated luminous paint and tritium adsorbed on solid carriers.

[Amdt. 173-162, 48 FR 10226, Mar. 10, 1983, as amended at 48 FR 13432, Mar. 31, 1983; 48 FR 31218, July 7, 1983]

§ 173.424 Excepted articles containing natural uranium or thorium.

Manufactured articles in which the sole radioactive material content is natural or depleted uranium or natural thorium are excepted from the specification packaging, shipping paper and certification, marking and labeling requirements of this subchapter and requirements of this subpart if:

(a) The outer surface of the uranium or thorium is enclosed in an inactive sheath made of metal or other durable protective material;

combination of these methods appropriate for the particular feature being evaluated:

(1) By performance of tests with prototypes or samples of the packaging or special form material as normally presented for transportation, in which case the contents of the packaging for the test shall simulate as closely as practicable the expected normal radioactive contents. The use of non-radioactive substitute contents is encouraged provided that the results of the testing take into account the radioactive characteristics of the contents for which it is being tested;

(2) By reference to a previous, satisfactory demonstration of compliance of a sufficiently similar nature;

(3) By performance of tests with models of appropriate scale incorporating those features that are significant with respect to the item under investigation, when engineering experience has shown results of those tests to be suitable for design purposes. When a scale model is used, the need for adjusting certain test parameters, such as the penetrator diameter or the compressive load, must be taken into account; or

(4) By engineering evaluation or comparative data.

(b) With respect to the initial conditions for the tests under §§ 173.463 through 173.469, except for the water immersion tests, compliance shall be based upon the assumption that the package is in equilibrium at an ambient temperature of 38°C (100°F).

[Amdt. 173-162, 48 FR 10226, Mar. 10, 1983, as amended at 48 FR 31219, July 7, 1983]

§ 173.462 Preparation of specimens for testing.

(a) Each specimen (i.e., sample, prototype or scale model) shall be examined before testing to identify and record faults or damage, including:

(1) Divergence from the specifications or drawings;

(2) Defects in construction;

(3) Corrosion or other deterioration; and

(4) Distortion of features.

(b) Any deviation found under paragraph (a) of this section from the specified design shall be corrected or suitably taken into account in the subsequent evaluation.

(c) The containment system of the packaging shall be clearly specified.

(d) The external features of the specimen shall be clearly identified so that reference may be made to any part of it.

§ 173.463 Packaging and shielding—testing for integrity.

After each of the applicable tests specified in §§ 173.465 and 173.466, the integrity of the packaging, or of the packaging and its shielding, shall be retained to the extent required by § 173.412(m) for the packaging being tested.

§ 173.465 Type A packaging tests.

(a) The proposed packaging with proposed contents must be capable of withstanding the tests prescribed in this section. One prototype may be used for all tests if the requirements of paragraph (b) of this section are complied with.

(b) *Water spray test.* The water spray test must precede each test or test sequence prescribed in this section. The water spray test shall simulate exposure to rainfall of approximately 5 centimeters (2 inches) per hour for at least one hour. The time interval between the end of the water spray test and the beginning of the next test shall be such that the water has soaked-in to the maximum extent without appreciable drying of the exterior of the specimen. In the absence of evidence to the contrary, this interval may be assumed to be two hours if the water spray is applied from four different directions simultaneously. However, no time interval may elapse if the water spray is applied from each of the four directions consecutively.

(c) *Free drop test.* The free drop test consists of a fall onto the target in a manner that causes maximum damage to the safety features being tested, and:

(1) For packages weighing 5,000 kilograms (11,000) pounds) or less, the distance of the fall measured from the lowest point of the packaging to the upper surface of the target shall not be less than 1.2 meters (4 feet).

(2) For packages weighing more than 5,000 kilograms (11,000 pounds), the distance of the fall shall not be less than the distance specified in Table 11, for the applicable packaging weight:

TABLE 11—FREE-FALL DISTANCE FOR PACKAGINGS WEIGHING MORE THAN 5,000 KILOGRAMS

Packaging weight		Free-fall distance	
Kilograms	Pounds	Feet	Meters
>5,000 to 10,000	>11,000 to 22,000	3	0.9
>10,000 to 15,000	>22,000 to 33,000	2	0.6
More than 15,000	More than 33,000	1	0.3

(3) For Fissile Class II packagings, the free drop specified in subparagraph (1) or (2) of this paragraph shall be preceded by a free drop from a height of .3 meter (1 foot) on each corner. For cylindrical packagings, the .3 meter (1 foot) drop shall be onto each of the quarters of each rim.

(4) For fiberboard or wood rectangular packages not exceeding 50 kilograms (110 pounds) in weight, a separate specimen of the proposed packaging shall be subjected to a free drop onto each corner from a height of .3 meter (1 foot).

(5) For fiberboard cylindrical packages weighing not more than 100 kilograms (220 pounds) a separate specimen of the proposed packaging shall be subjected to a free drop onto each of the quarters of each rim from a height of .3 meter (1 foot).

(6) The target shall have a flat, horizontal surface of such mass and rigidity that any increase in its resistance to displacement or deformation upon impact by the specimen would not significantly increase the damage to the specimen.

(d) *Compression test.* The compression test shall last for a period of at least 24 hours and consists of a compressive load equivalent to the greater ¶f the following:

(1) Five times the weight of the actual package; or

(2) 1300 kilograms per square meter (265 pounds per square foot) multiplied by the vertically projected area of the package. The compressive load shall be applied uniformly to two opposite sides of the packaging specimen, one of which must be the base on which the package would normally stand.

(e) *Penetration test.* For the penetration test the packaging specimen shall be placed on a rigid, flat, horizontal surface that will not move while the test is being performed. The test shall consist of:

(1) A bar of 3.2 centimeters (1.25 inches) in diameter with a hemispherical end, weighing 6 kilograms (13.2 pounds) being dropped with its longitudinal axis vertical, onto the center of the weakest part of the packaging specimen, so that, if it penetrates far enough, it will hit the containment system. The bar must not be deformed by the test; and

(2) The distance of the fall of the bar measured from its lower end to the upper surface of the packaging specimen shall not be less than 1 meter (3.3 feet).

[Amdt. 173-162, 48 FR 10226, Mar. 10, 1983, as amended at 48 FR 31219, July 7, 1983; Amdt. 173-16, 48 FR 50461, Nov. 1, 1983; Amdt. 173-196, 51 FR 5973, Feb. 18, 1986]

§ 173.466 Additional tests for Type A packagings designed for liquids and gases.

(a) In addition to the tests prescribed in § 173.465, Type A packagings designed for liquids and gases shall be capable of withstanding the following tests:

(1) *Free drop test.* The packaging specimen shall fall onto the target in a manner which will cause it to suffer the maximum damage to its containment. The distance of the fall measured from the lowest part of the packaging specimen to the upper surface of the target shall be not less than 9 meters (30 feet).

(2) *Penetration test.* The specimen must be subjected to the test specified in § 173.465(e) except that the distance of the fall shall be 1.7 meters (5.5 feet).

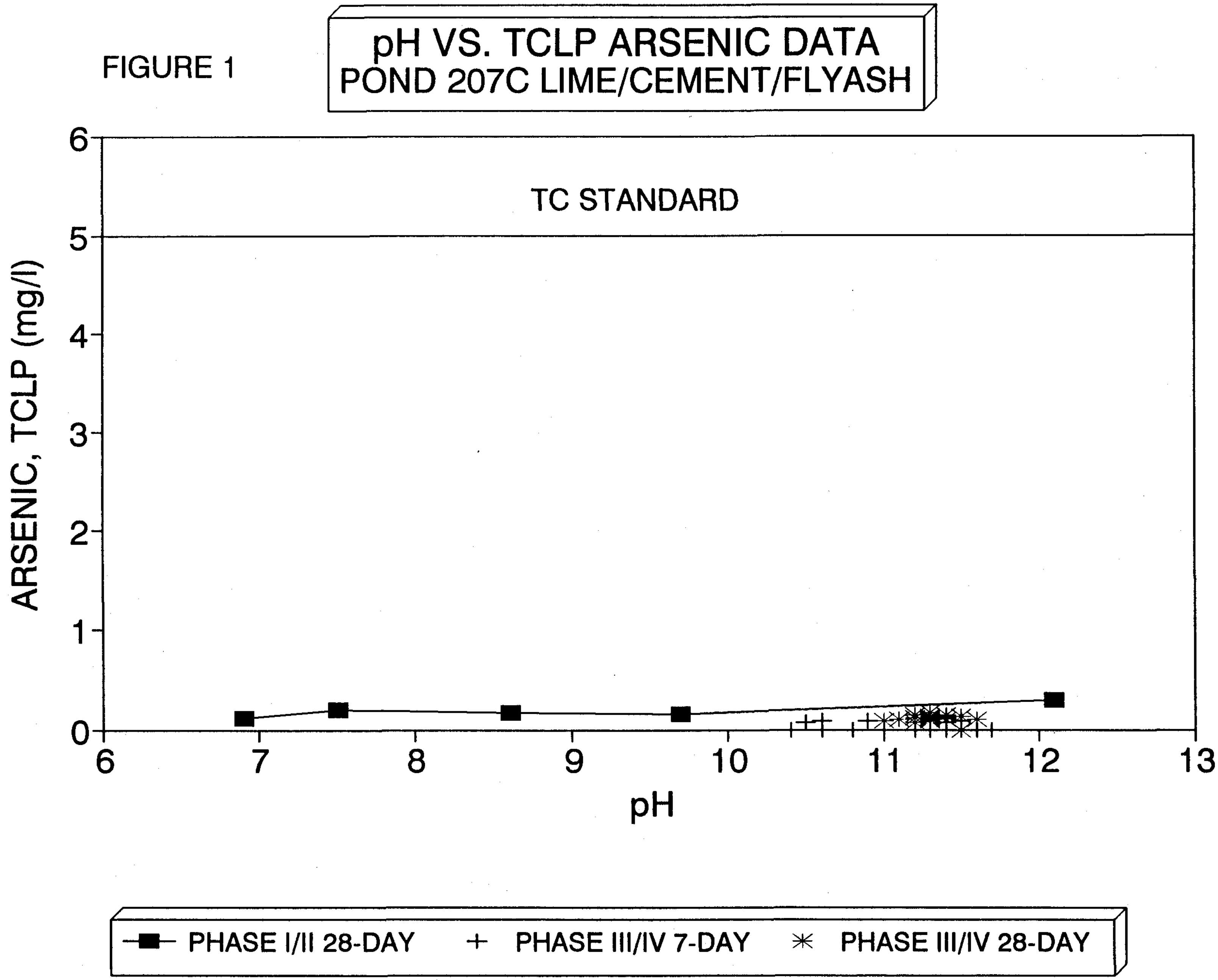
ATTACHMENT F

Contents:

ATTACHMENT F-1

GROUP I
POND 207C
LIME/CEMENT/FLYASH

FIGURE 1



pH VS. TCLP ARSENIC DATA
POND 207C LIME/CEMENT/FLYASH
TC STANDARD
ARSENIC, TCLP (mg/l)
0
1
2
3
4
5
6
6
7
8
9
10
11
12
13
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 2

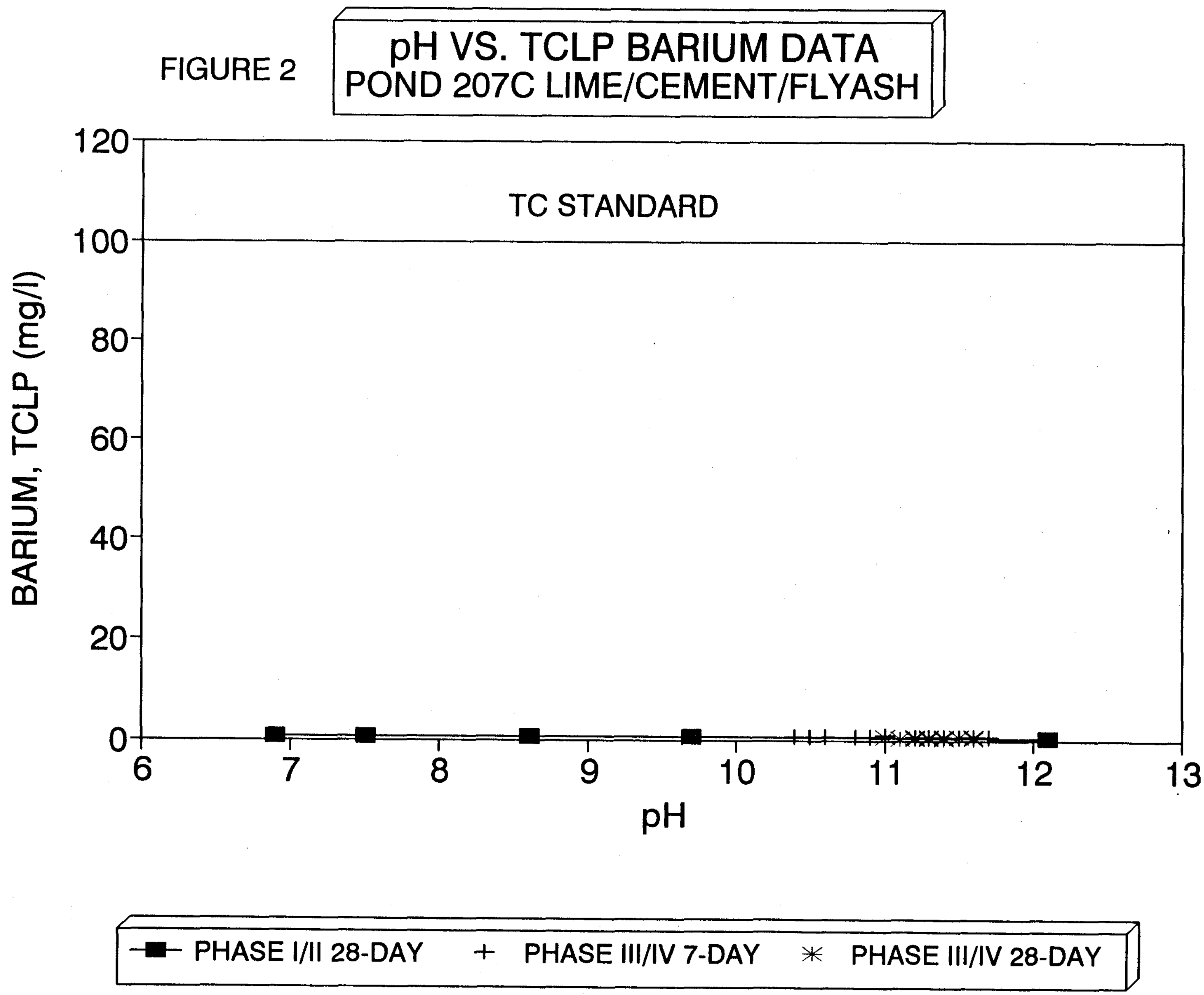
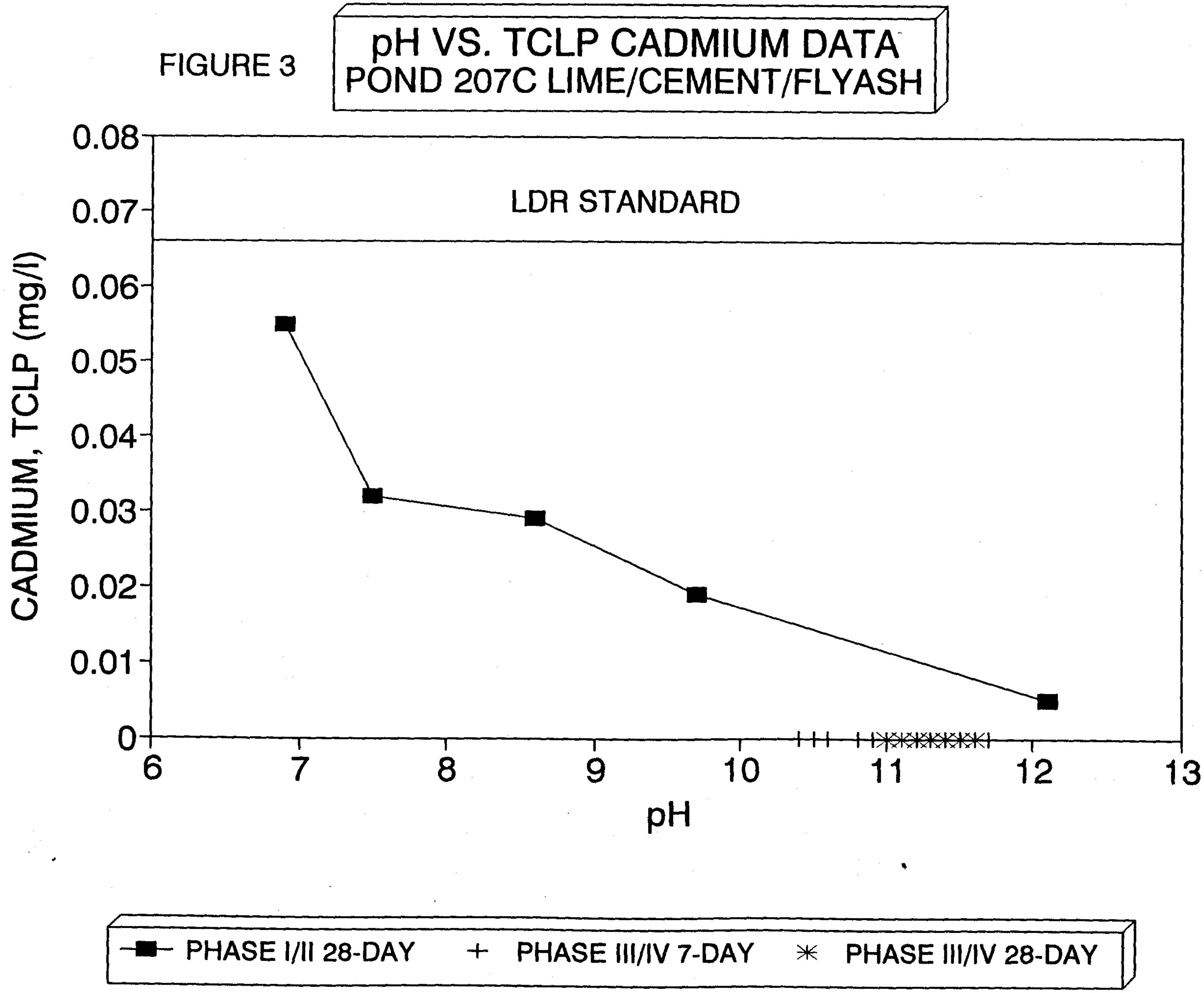

pH VS. TCLP BARIUM DATA
POND 207C LIME/CEMENT/FLYASH
TC STANDARD
BARIUM, TCLP (mg/l)
120
100
80
60
40
20
0
6
7
8
9
10
11
12
13
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 3



pH VS. TCLP CADMIUM DATA
POND 207C LIME/CEMENT/FLYASH
LDR STANDARD
CADMIUM, TCLP (mg/l)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
6
7
8
9
10
11
12
13
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 4

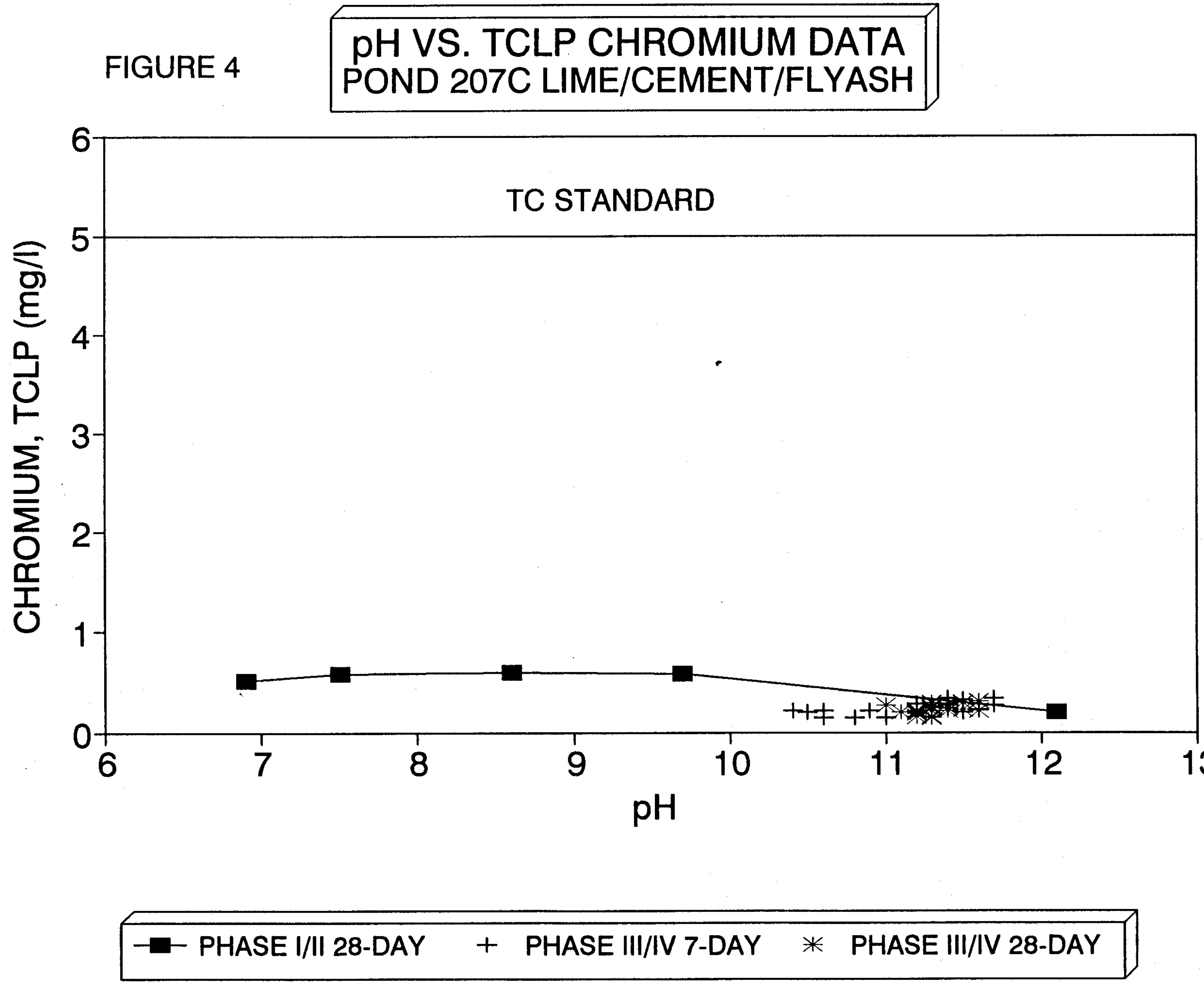

pH VS. TCLP CHROMIUM DATA
POND 207C LIME/CEMENT/FLYASH
TC STANDARD
CHROMIUM, TCLP (mg/l)
0
1
2
3
4
5
6
pH
6
7
8
9
10
11
12
13
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 5

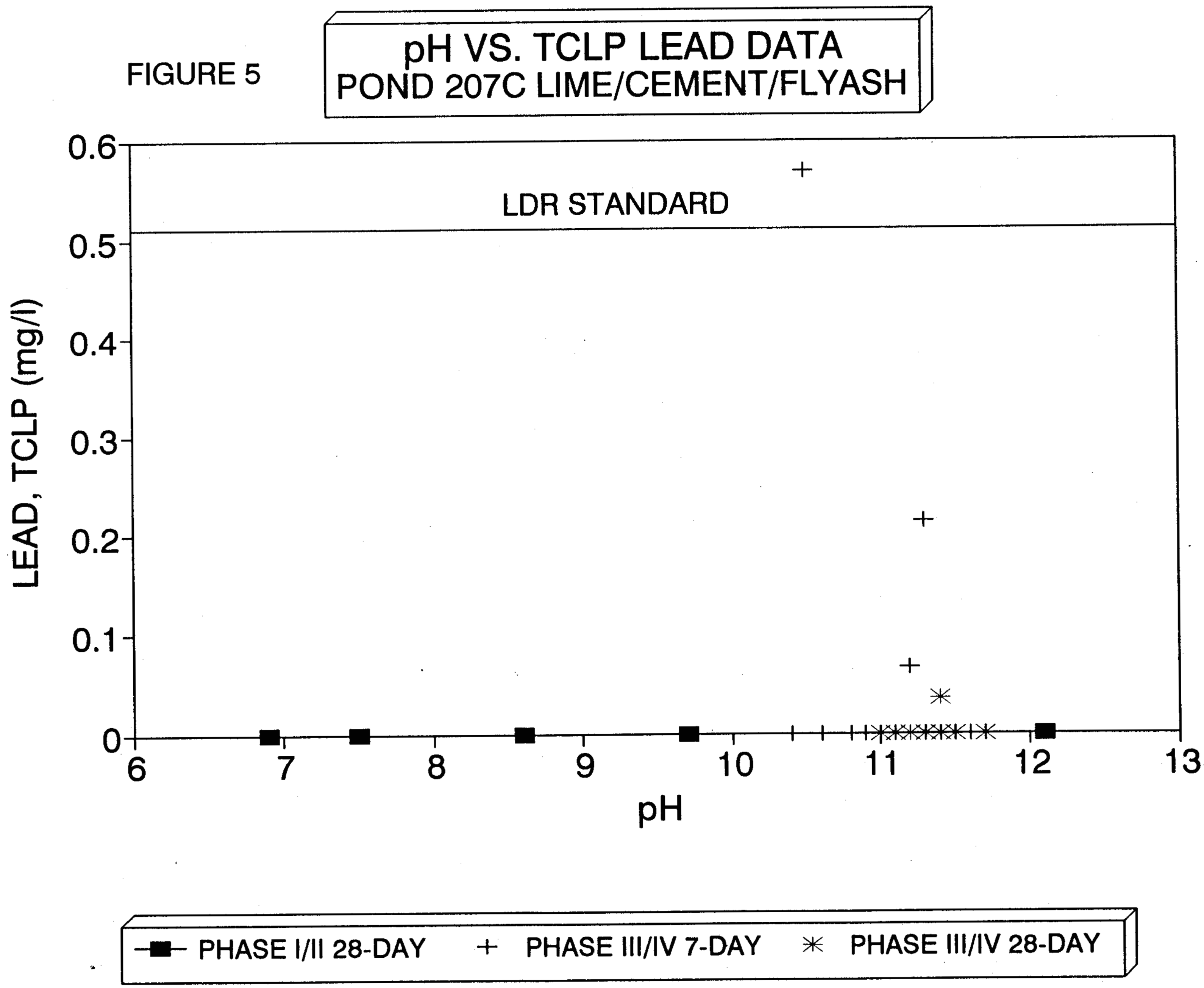

pH VS. TCLP LEAD DATA
POND 207C LIME/CEMENT/FLYASH
LEAD, TCLP (mg/l)
0.6
0.5
0.4
0.3
0.2
0.1
0
LDR STANDARD
6
7
8
9
10
11
12
13
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 6

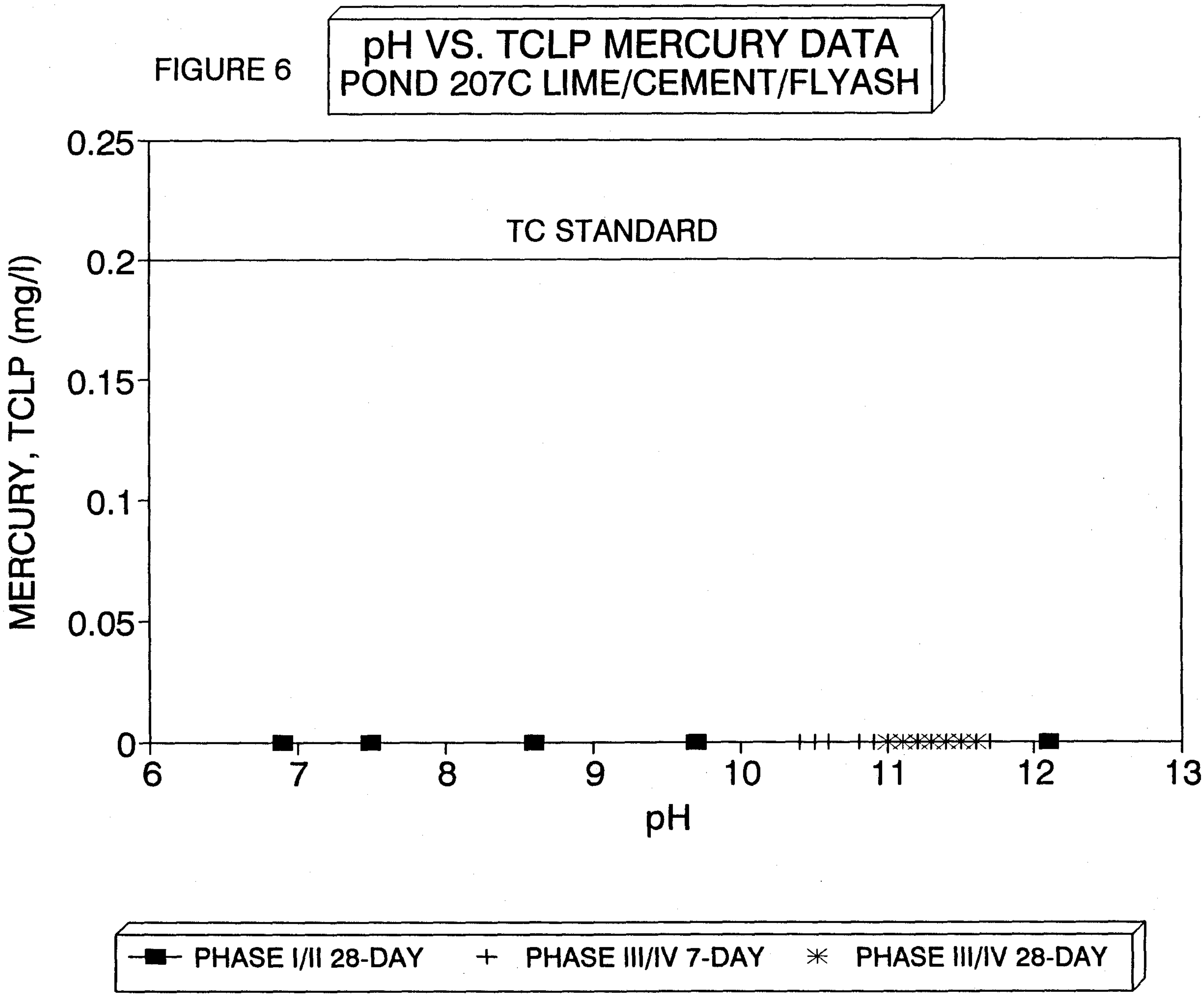
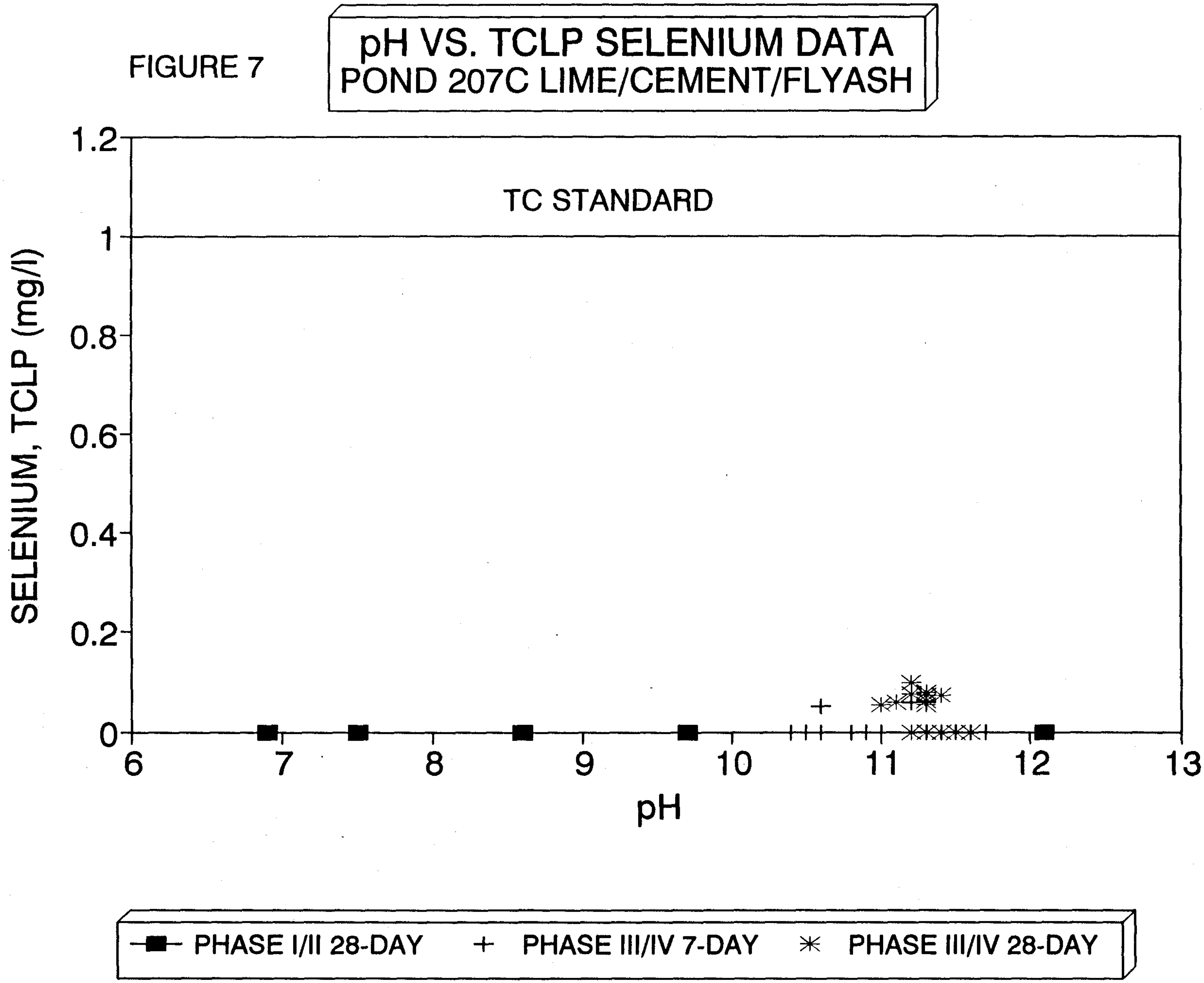

pH VS. TCLP MERCURY DATA
POND 207C LIME/CEMENT/FLYASH
TC STANDARD
MERCURY, TCLP (mg/l)
0.25
0.2
0.15
0.1
0.05
0
6
7
8
9
10
11
12
13
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 7



pH VS. TCLP SELENIUM DATA
POND 207C LIME/CEMENT/FLYASH
TC STANDARD
SELENIUM, TCLP (mg/l)
1.2
1
0.8
0.6
0.4
0.2
0
6
7
8
9
10
11
12
13
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 8

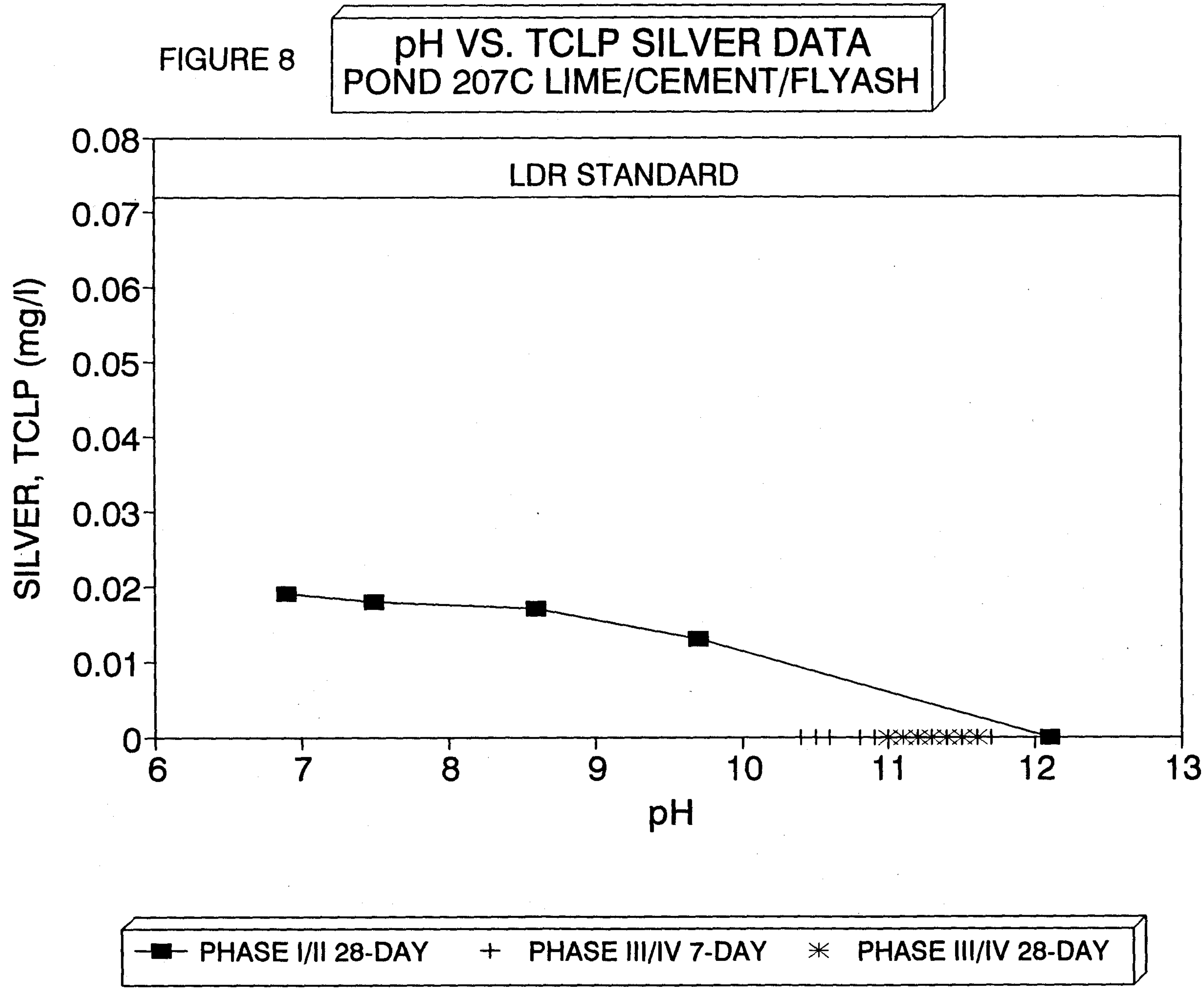
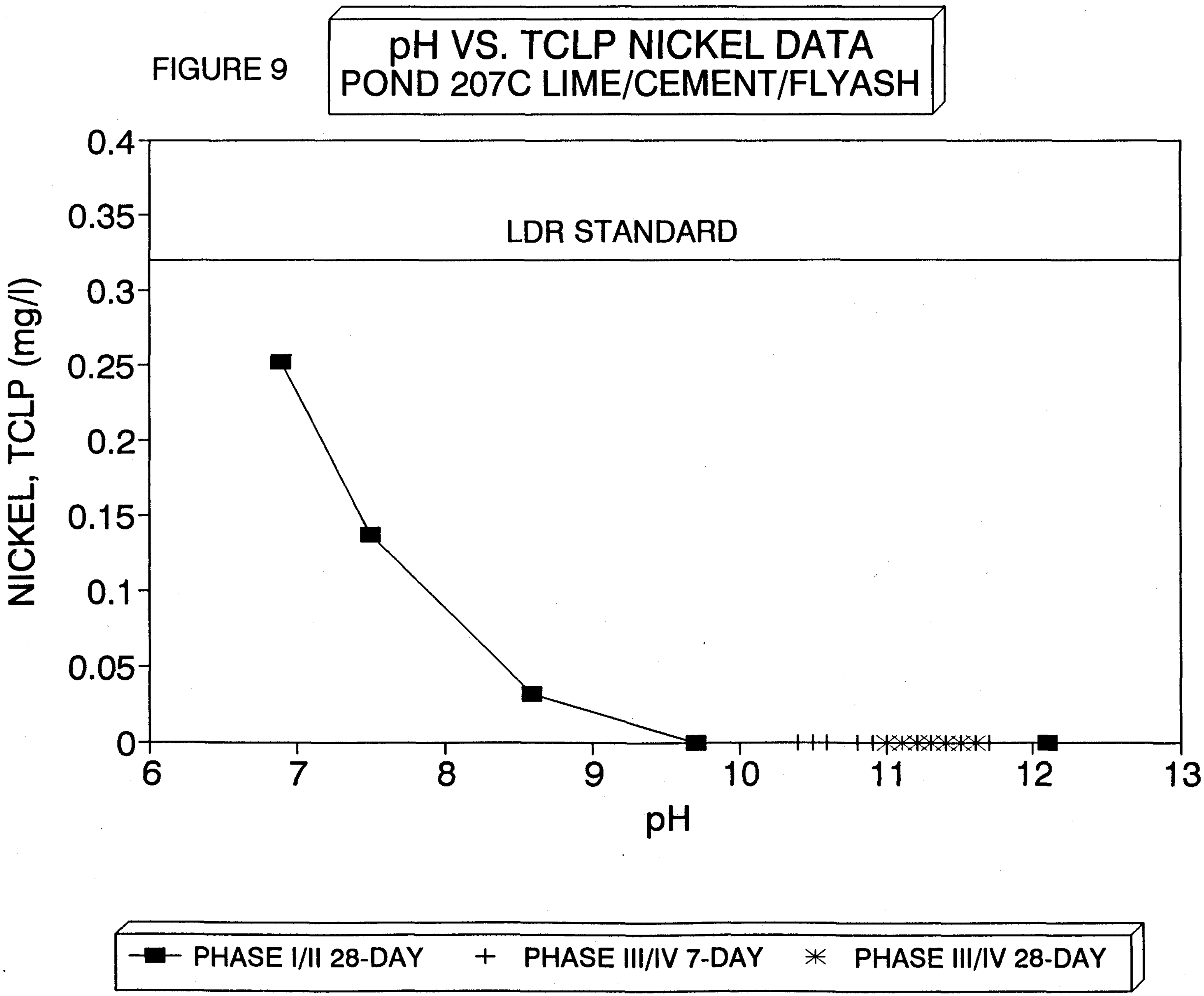

pH VS. TCLP SILVER DATA
POND 207C LIME/CEMENT/FLYASH
LDR STANDARD
SILVER, TCLP (mg/l)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
6
7
8
9
10
11
12
13
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 9



pH VS. TCLP NICKEL DATA
POND 207C LIME/CEMENT/FLYASH
LDR STANDARD
NICKEL, TCLP (mg/l)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
6
7
8
9
10
11
12
13
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

ATTACHMENT F-2

GROUP II
POND 207C
LIME/CEMENT/FLYASH PLUS LATEX

FIGURE 10

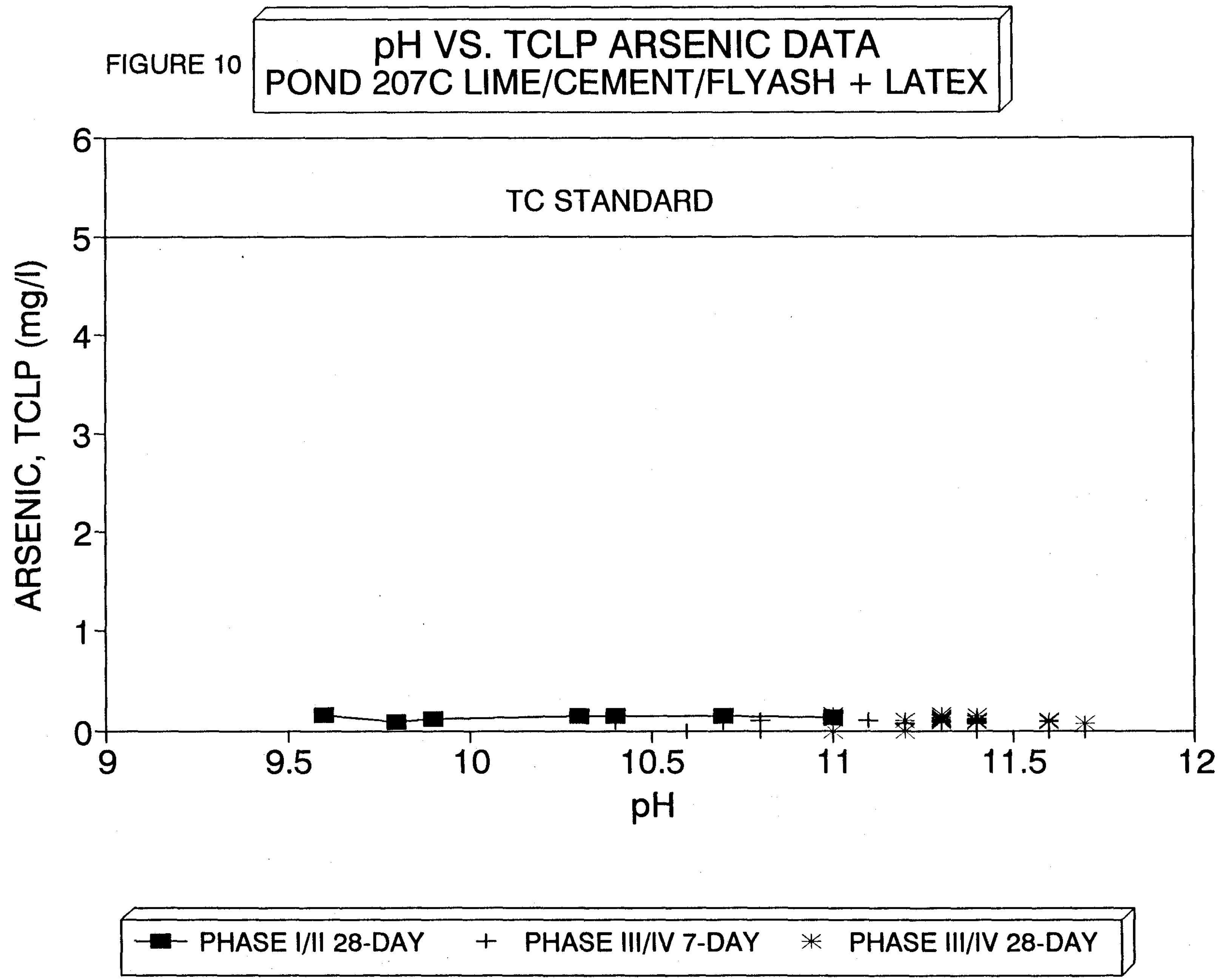
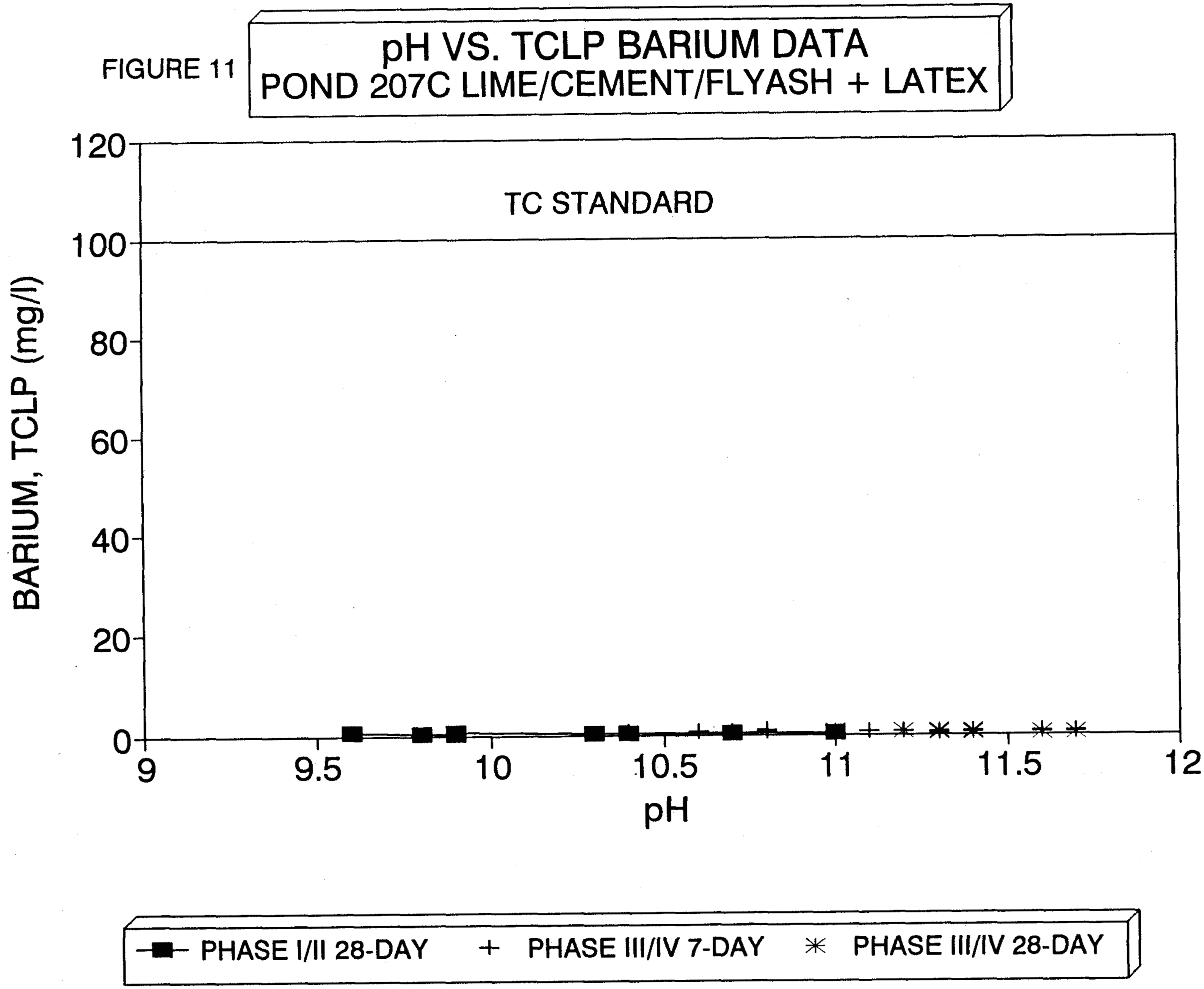

pH VS. TCLP ARSENIC DATA
POND 207C LIME/CEMENT/FLYASH + LATEX
TC STANDARD
ARSENIC, TCLP (mg/l)
6
5
4
3
2
1
0
9
9.5
10
10.5
11
11.5
12
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 11



pH VS. TCLP BARIUM DATA
POND 207C LIME/CEMENT/FLYASH + LATEX
TC STANDARD
BARIUM, TCLP (mg/l)
120
100
80
60
40
20
0
9
9.5
10
10.5
11
11.5
12
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 12

pH VS. TCLP CADMIUM DATA
POND 207C LIME/CEMENT/FLYASH + LATEX

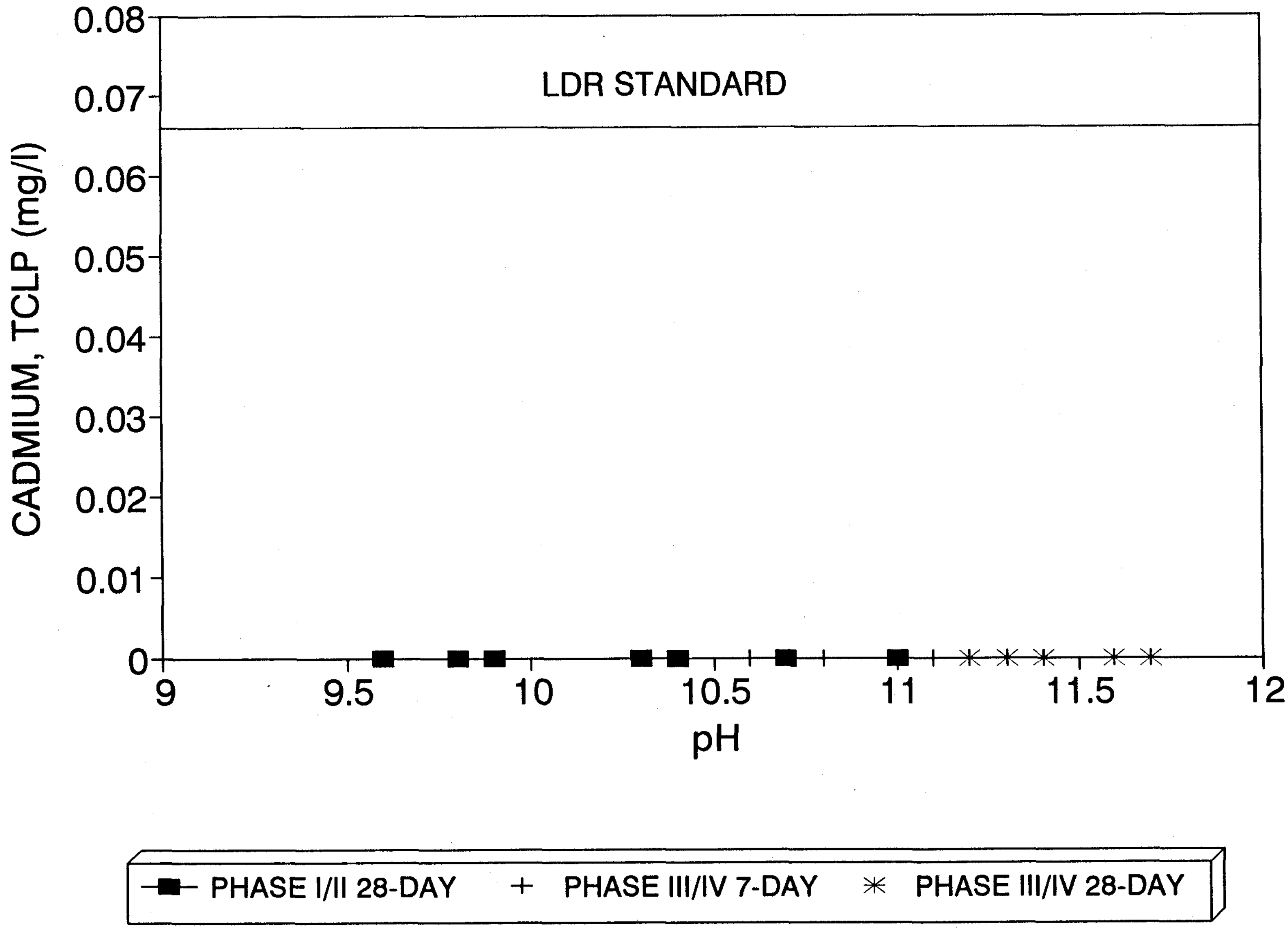
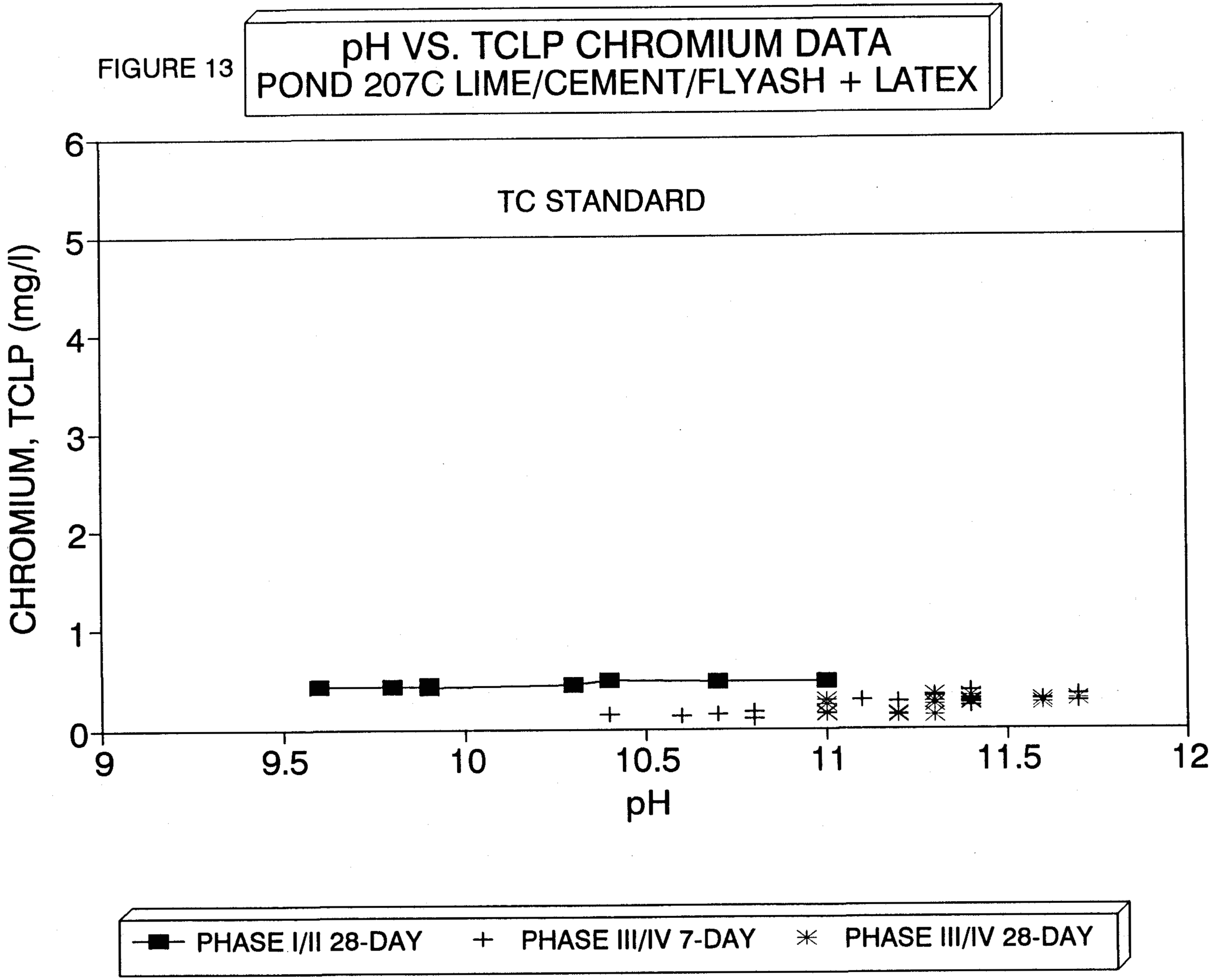


FIGURE 13



pH VS. TCLP CHROMIUM DATA
POND 207C LIME/CEMENT/FLYASH + LATEX
TC STANDARD
CHROMIUM, TCLP (mg/l)
6
5
4
3
2
1
0
9
9.5
10
10.5
11
11.5
12
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 14

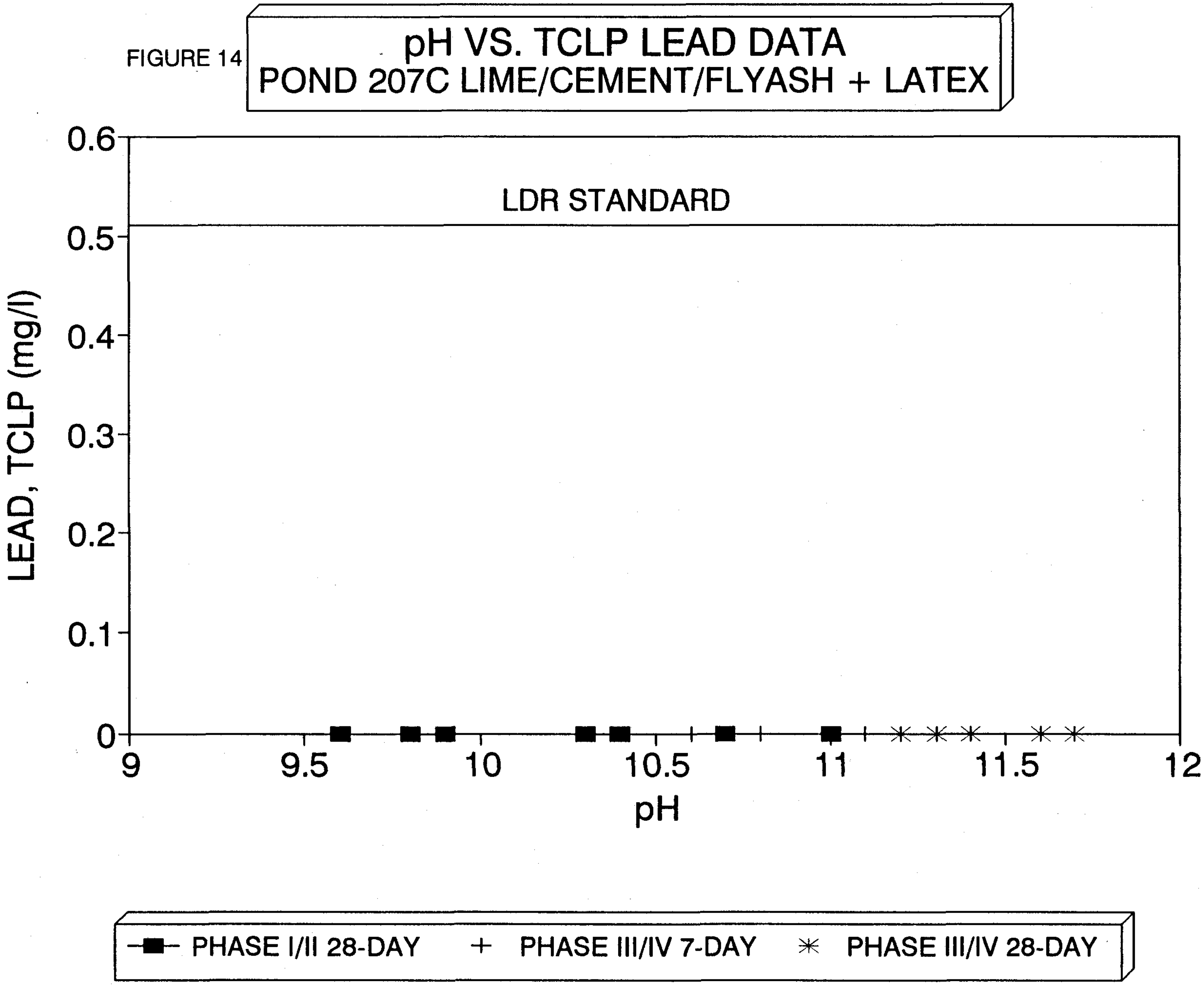

pH VS. TCLP LEAD DATA
POND 207C LIME/CEMENT/FLYASH + LATEX
LDR STANDARD
LEAD, TCLP (mg/l)
0.6
0.5
0.4
0.3
0.2
0.1
0
9
9.5
10
10.5
11
11.5
12
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 15

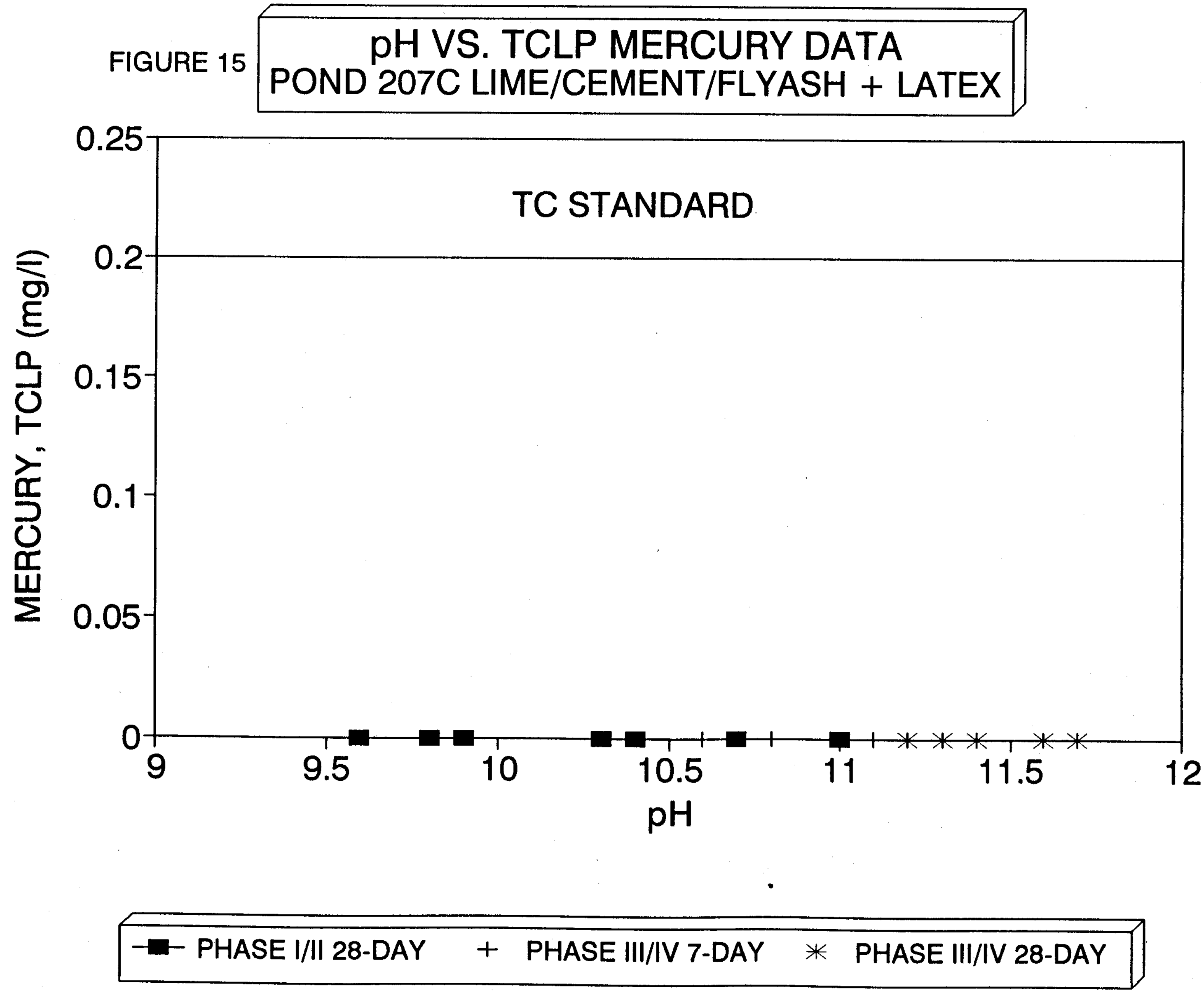
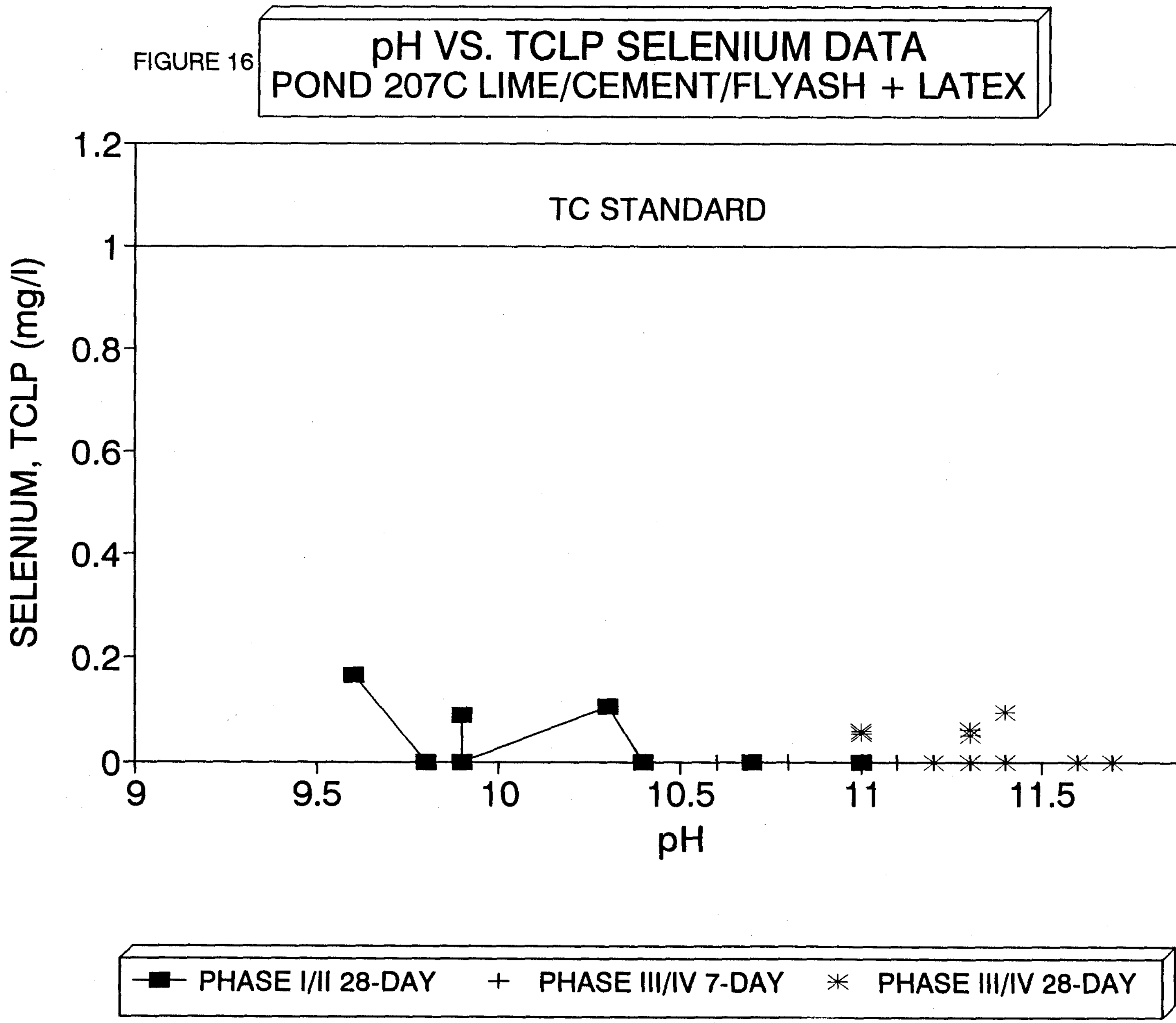

pH VS. TCLP MERCURY DATA
POND 207C LIME/CEMENT/FLYASH + LATEX
TC STANDARD
MERCURY, TCLP (mg/l)
0.25
0.2
0.15
0.1
0.05
0
9
9.5
10
10.5
11
11.5
12
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 16



pH VS. TCLP SELENIUM DATA
POND 207C LIME/CEMENT/FLYASH + LATEX
TC STANDARD
SELENIUM, TCLP (mg/l)
1.2
1
0.8
0.6
0.4
0.2
0
9
9.5
10
10.5
11
11.5
12
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 17

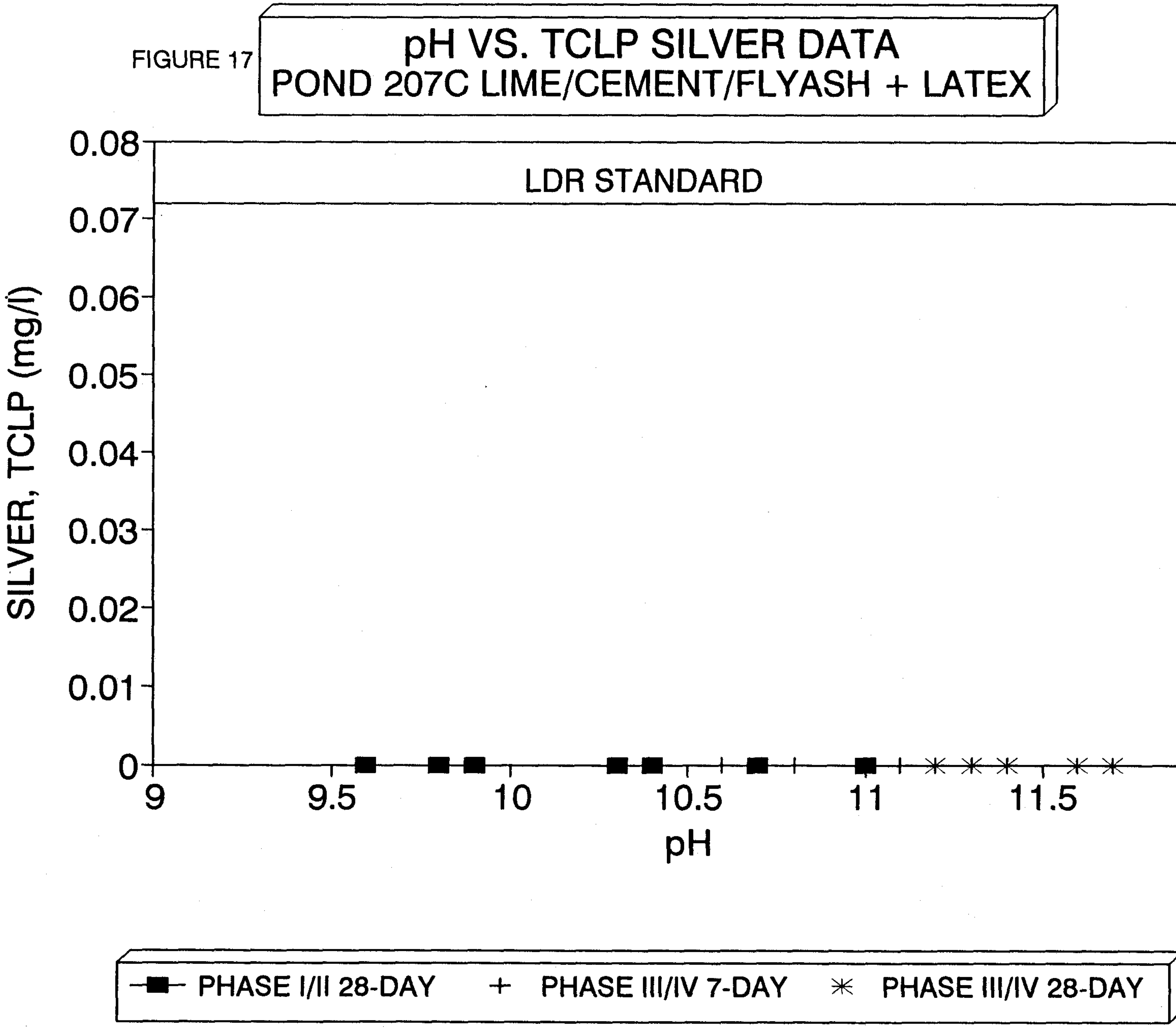
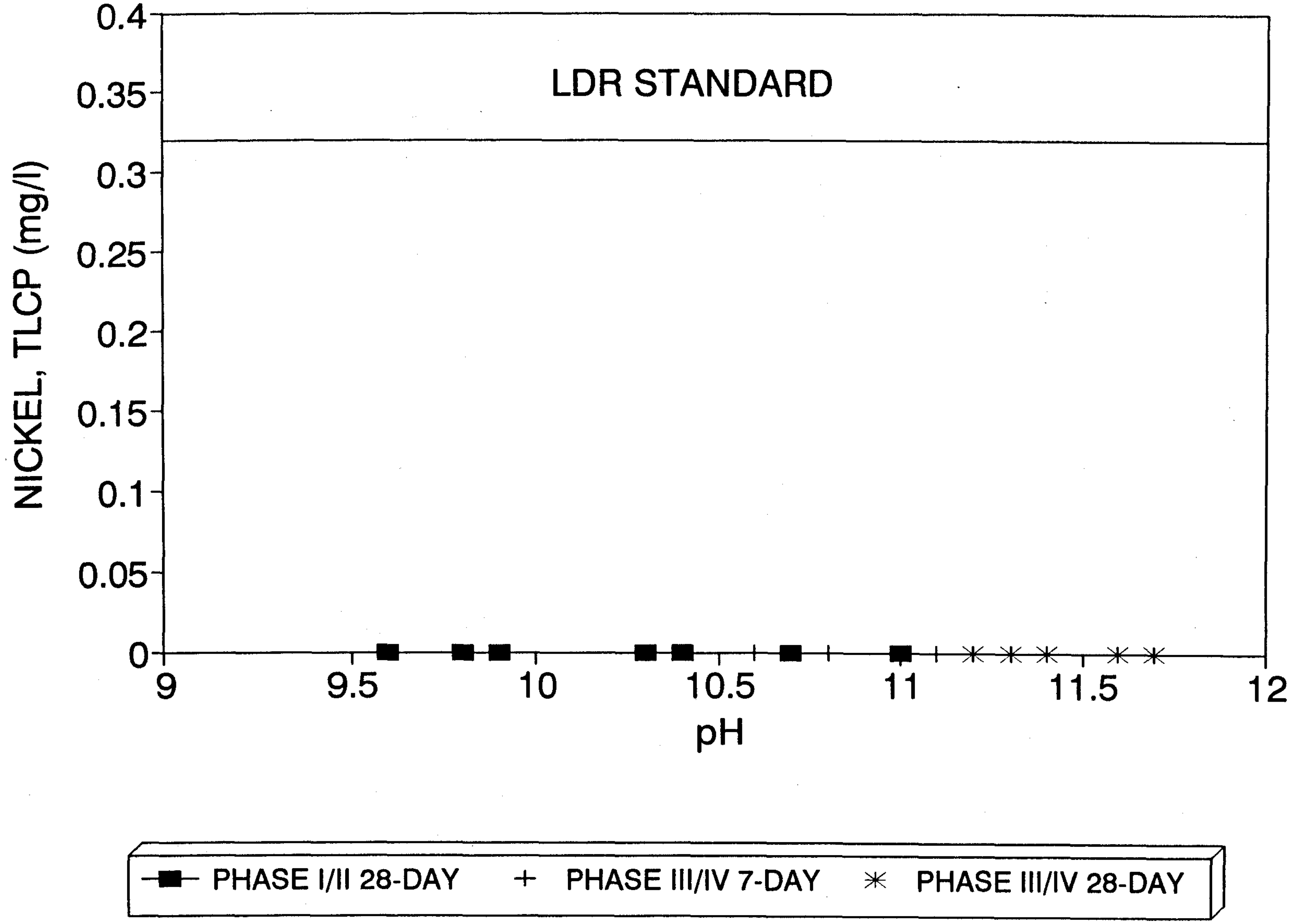

pH VS. TCLP SILVER DATA
POND 207C LIME/CEMENT/FLYASH + LATEX
LDR STANDARD
SILVER, TCLP (mg/l)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
9
9.5
10
10.5
11
11.5
12
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 18

pH VS. TCLP NICKEL DATA
POND 207C LIME/CEMENT/FLYASH + LATEX



ATTACHMENT F-3

POND 207 AND CLARIFIER
LIME/CEMENT/FLYASH

FIGURE 19

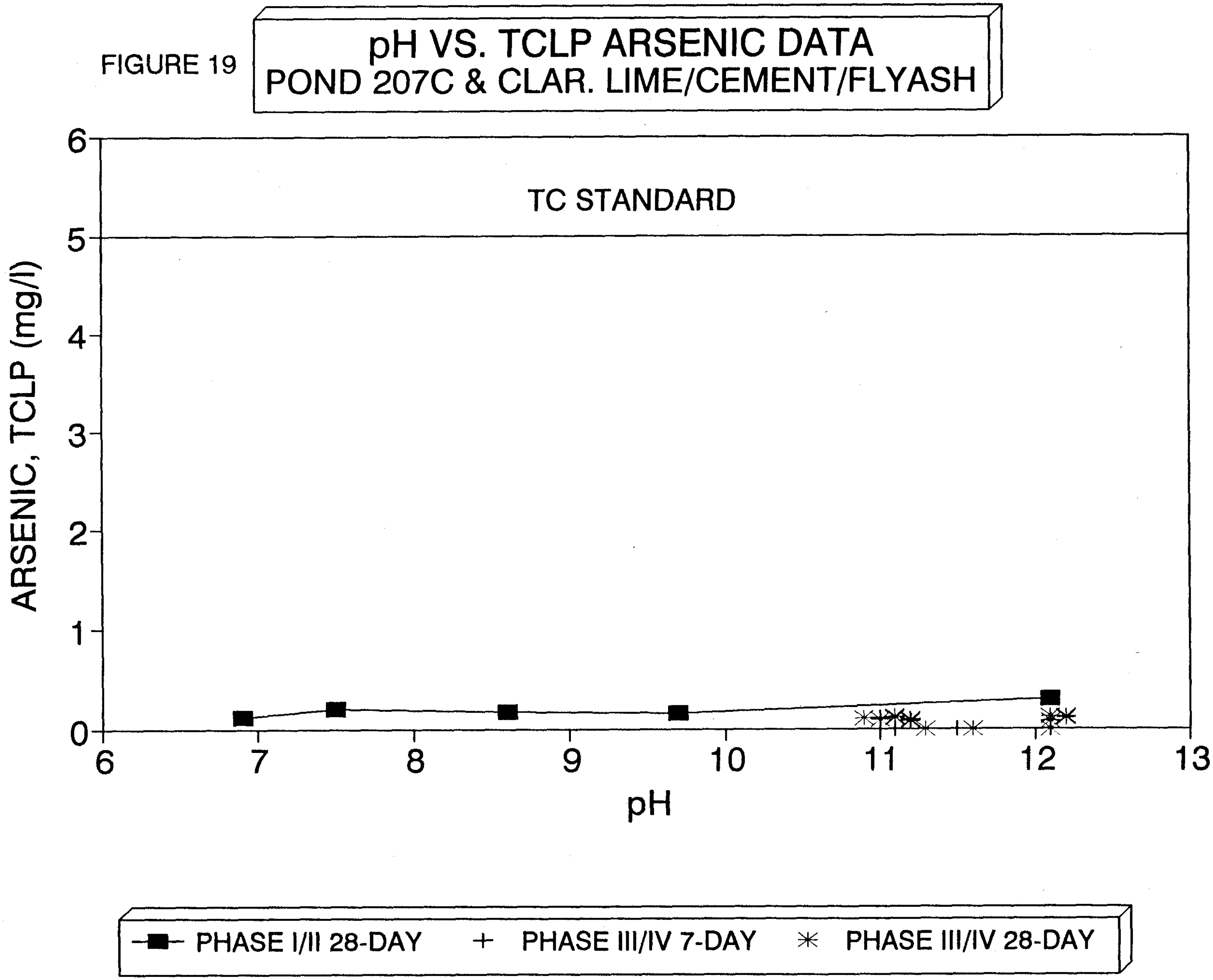

pH VS. TCLP ARSENIC DATA
POND 207C & CLAR. LIME/CEMENT/FLYASH
TC STANDARD
ARSENIC, TCLP (mg/l)
0
1
2
3
4
5
6
6
7
8
9
10
11
12
13
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 20

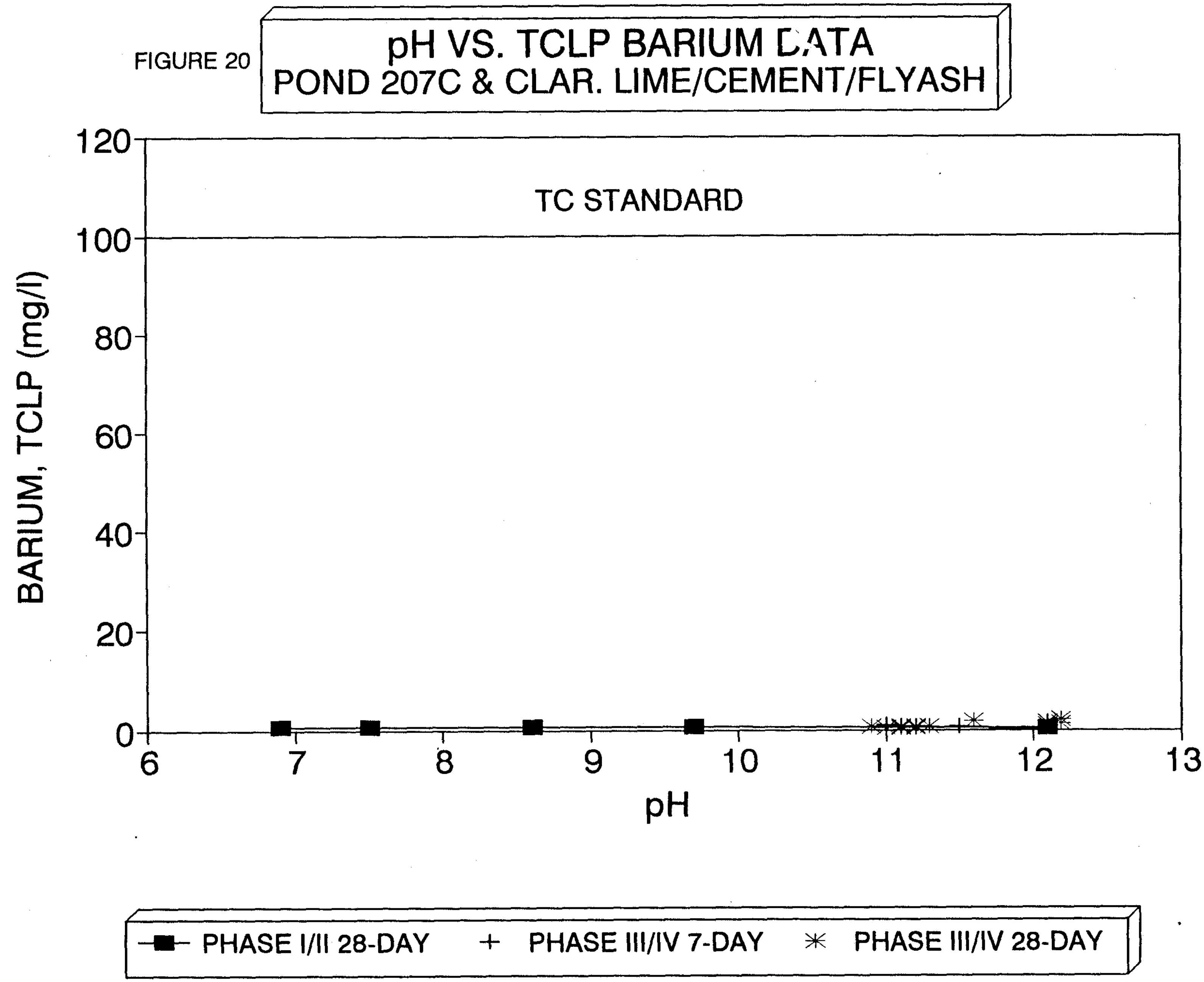

pH VS. TCLP BARIUM DATA
POND 207C & CLAR. LIME/CEMENT/FLYASH
TC STANDARD
BARIUM, TCLP (mg/l)
120
100
80
60
40
20
0
6
7
8
9
10
11
12
13
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 21

pH VS. TCLP CADMIUM DATA
POND 207C & CLAR. LIME/CEMENT/FLYASH

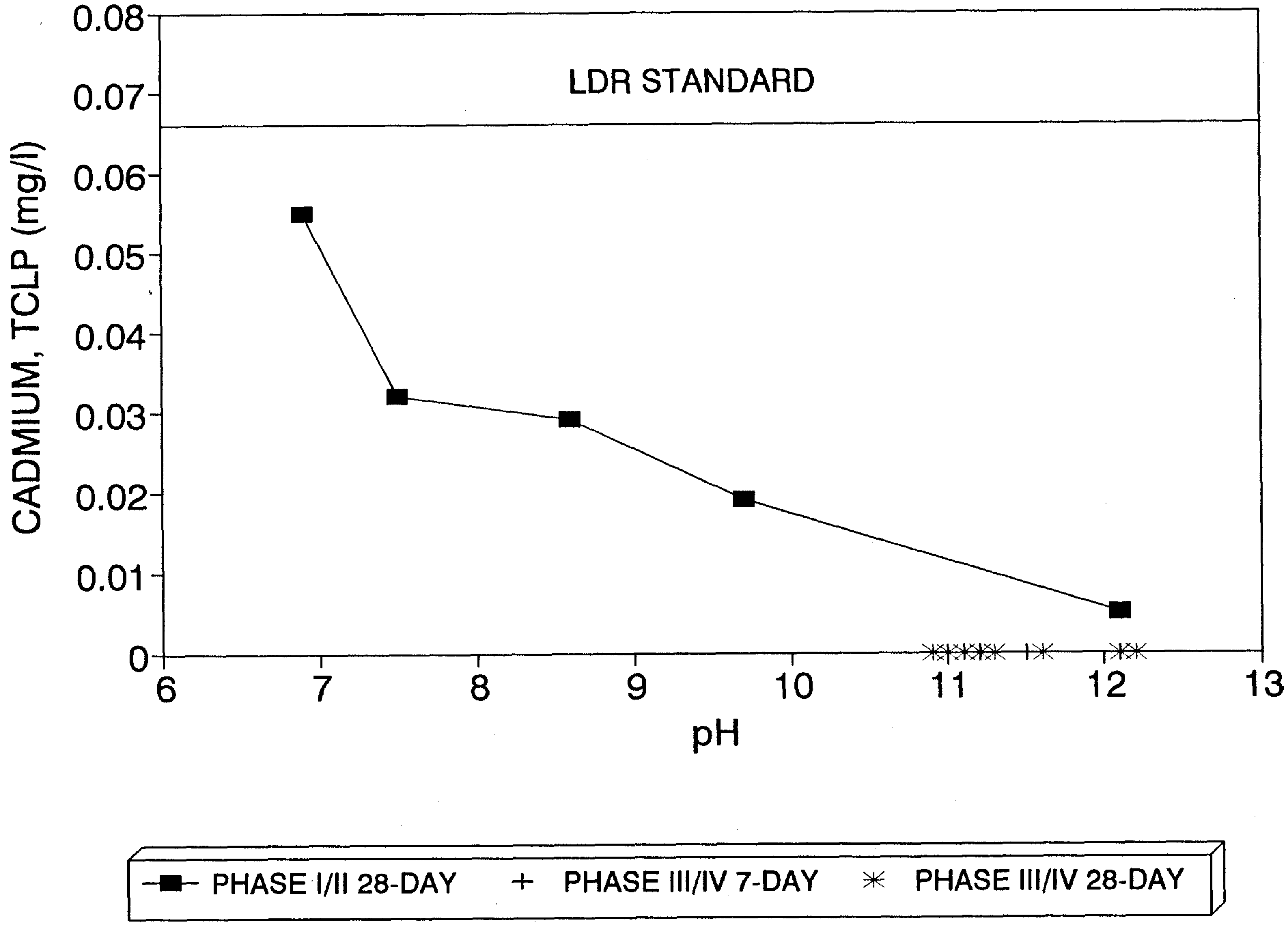
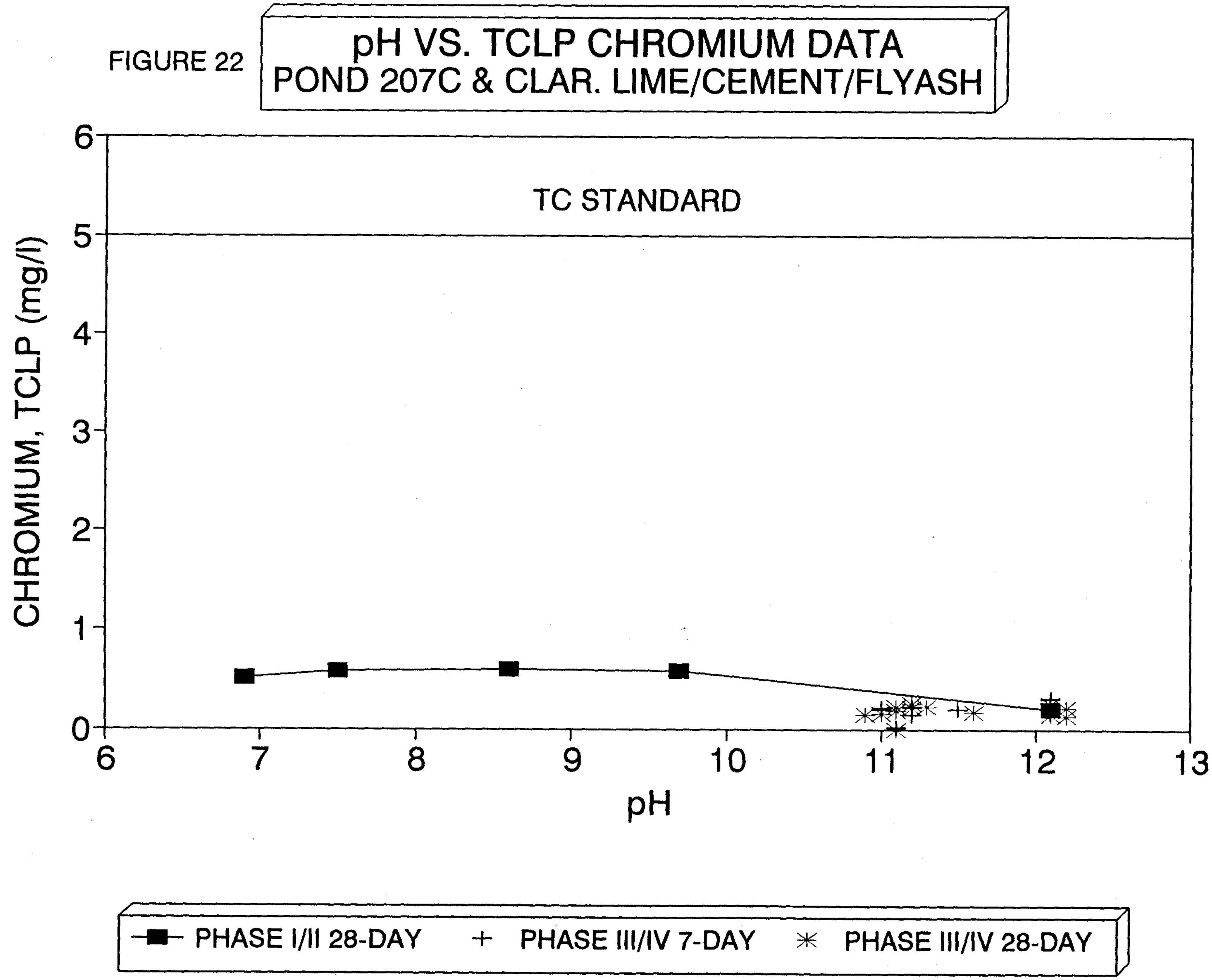
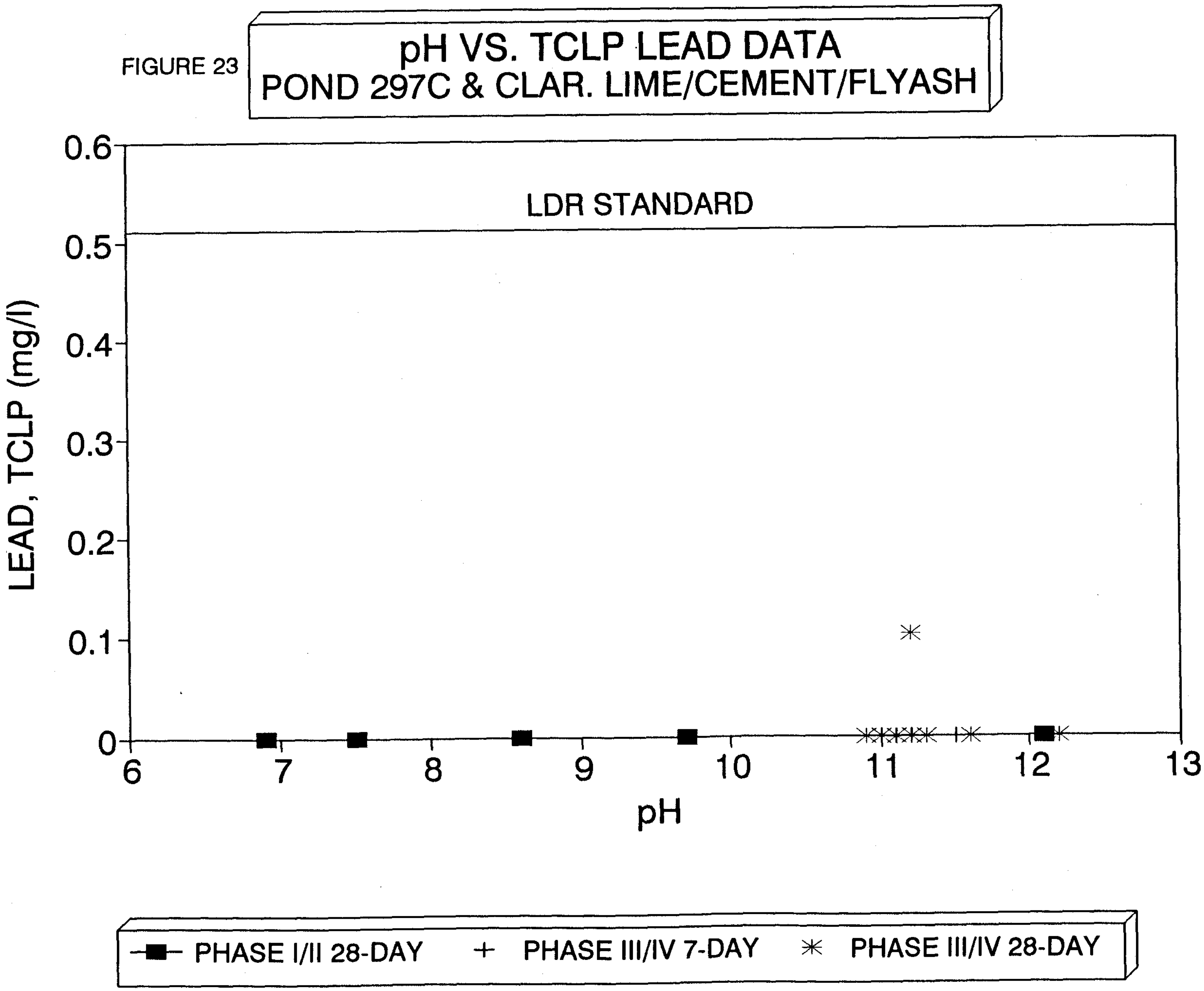


FIGURE 22



pH VS. TCLP CHROMIUM DATA
POND 207C & CLAR. LIME/CEMENT/FLYASH
TC STANDARD
CHROMIUM, TCLP (mg/l)
6
5
4
3
2
1
0
6
7
8
9
10
11
12
13
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 23



pH VS. TCLP LEAD DATA
POND 297C & CLAR. LIME/CEMENT/FLYASH
LDR STANDARD
LEAD, TCLP (mg/l)
0.6
0.5
0.4
0.3
0.2
0.1
0
6
7
8
9
10
11
12
13
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 24

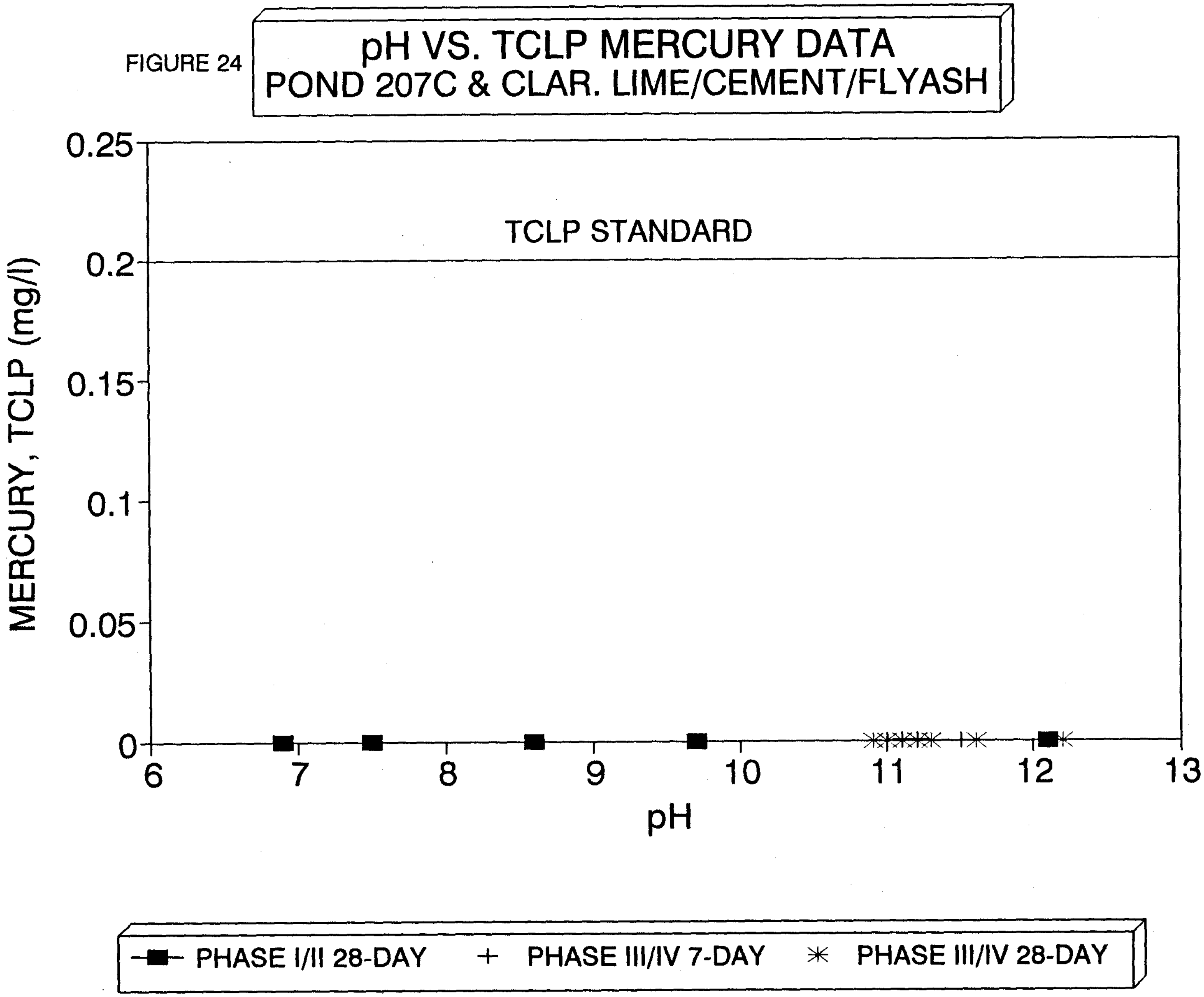

pH VS. TCLP MERCURY DATA
POND 207C & CLAR. LIME/CEMENT/FLYASH
MERCURY, TCLP (mg/l)
0.25
0.2
0.15
0.1
0.05
0
TCLP STANDARD
6
7
8
9
10
11
12
13
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 25

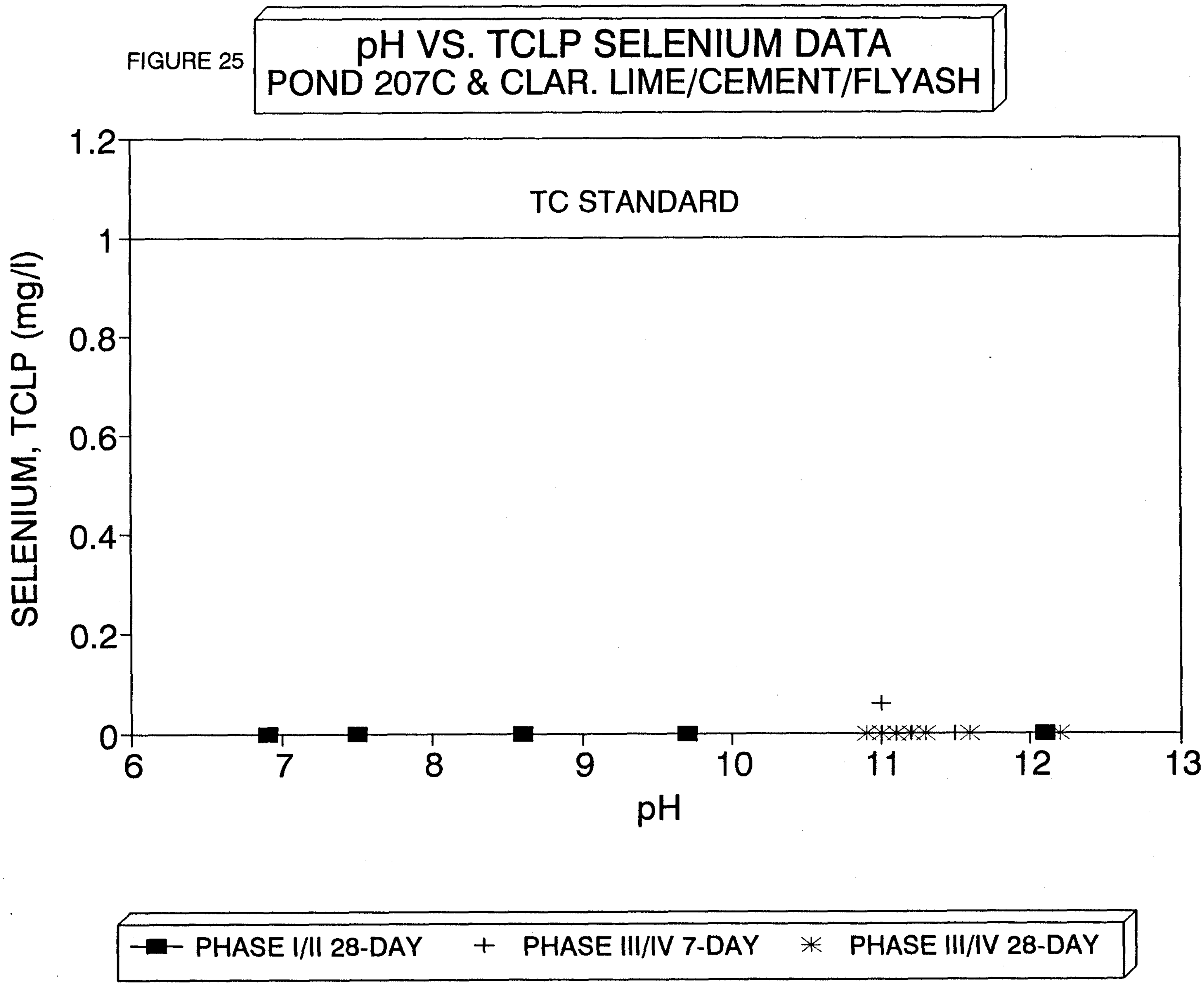
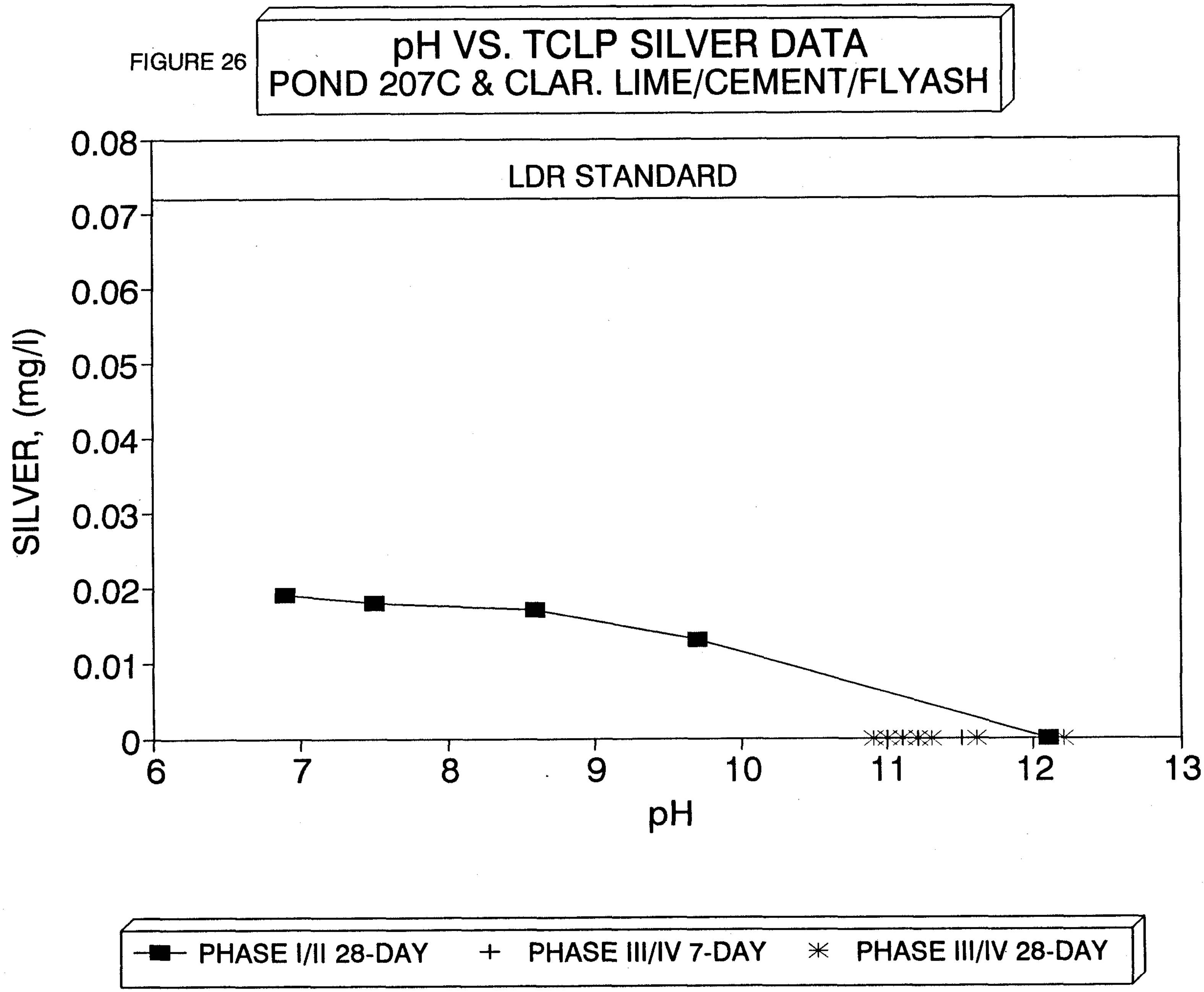
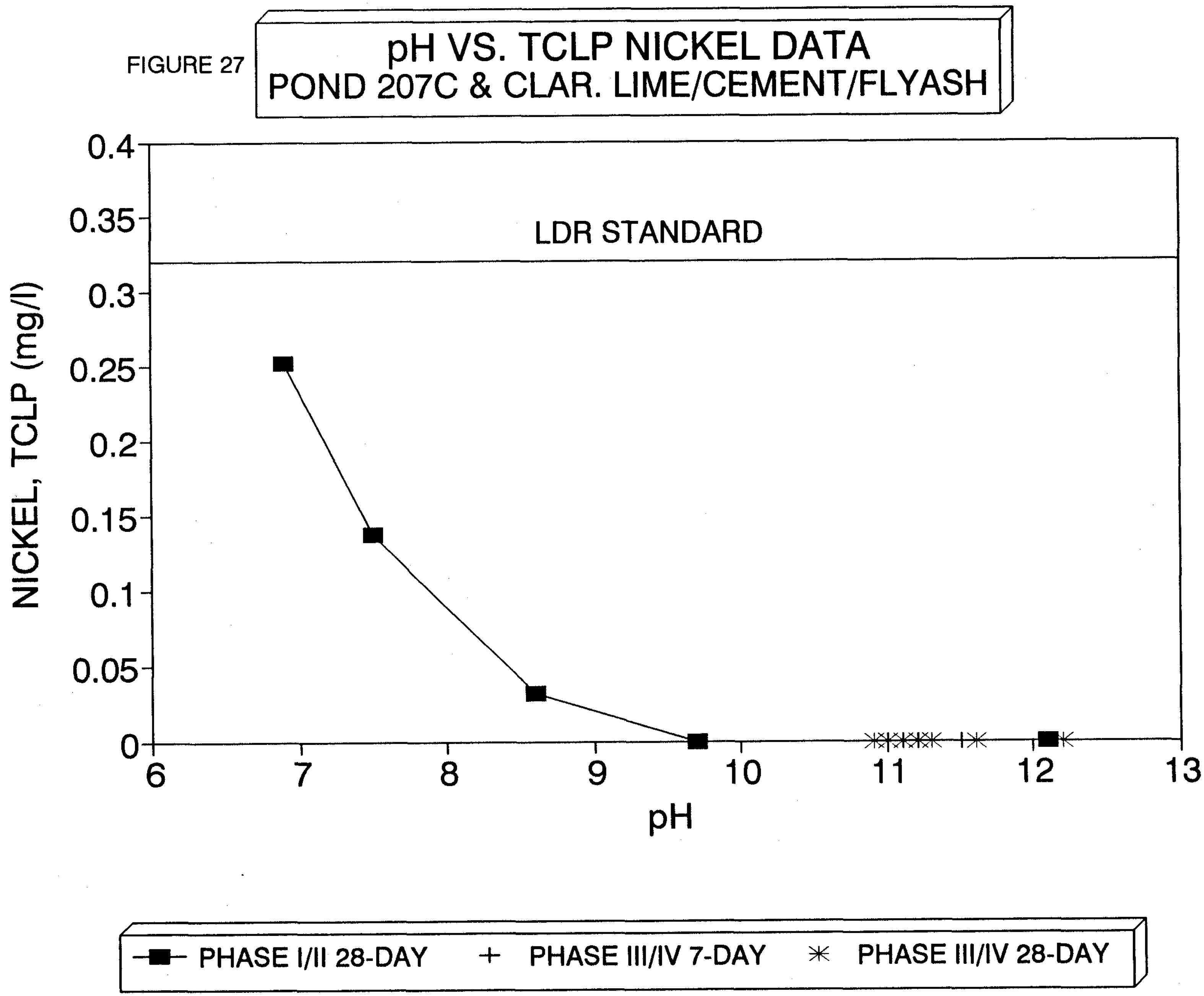

pH VS. TCLP SELENIUM DATA
POND 207C & CLAR. LIME/CEMENT/FLYASH
TC STANDARD
SELENIUM, TCLP (mg/l)
1.2
1
0.8
0.6
0.4
0.2
0
6
7
8
9
10
11
12
13
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 26



pH VS. TCLP SILVER DATA
POND 207C & CLAR. LIME/CEMENT/FLYASH
LDR STANDARD
SILVER, (mg/l)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
6
7
8
9
10
11
12
13
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

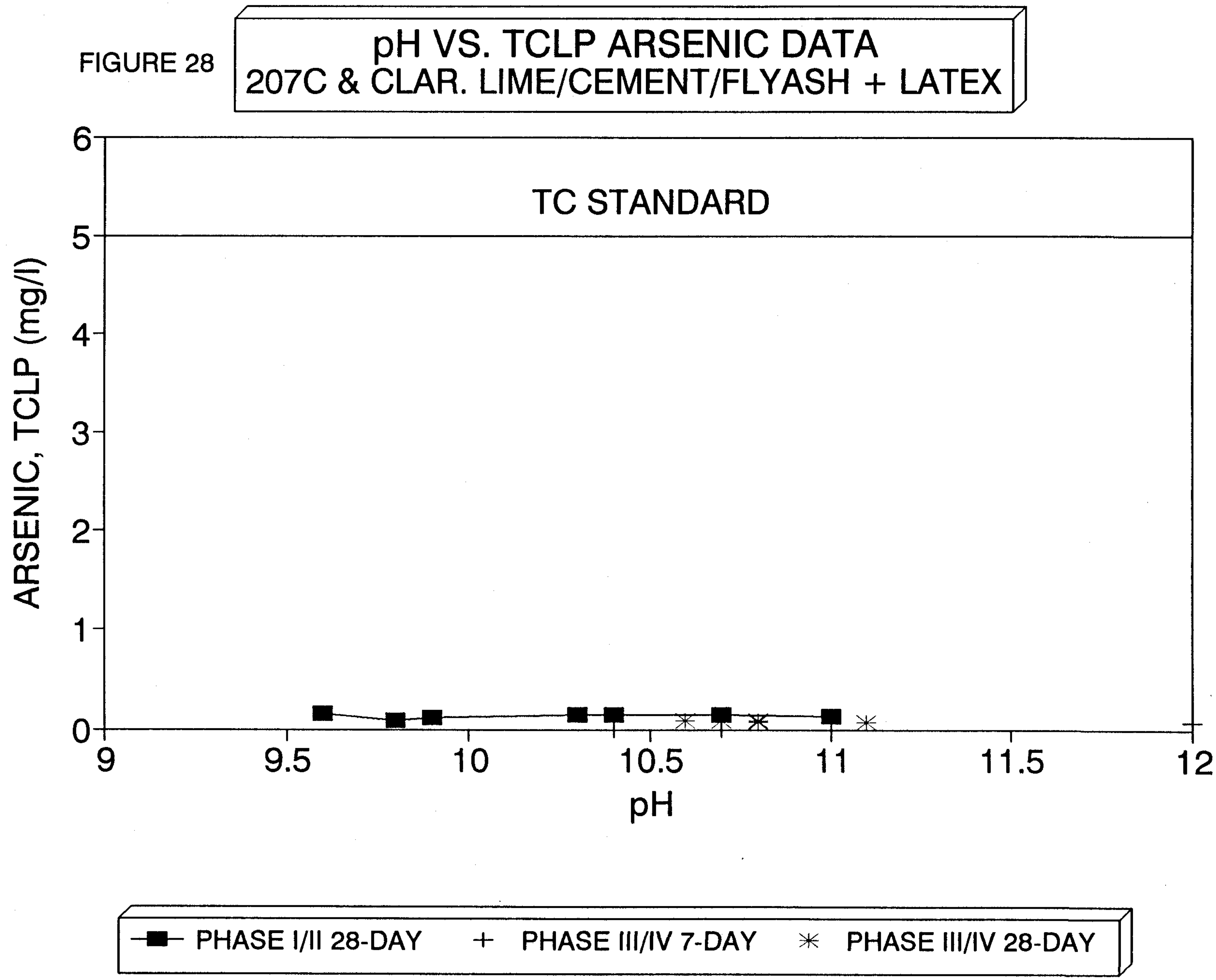
FIGURE 27


pH VS. TCLP NICKEL DATA
POND 207C & CLAR. LIME/CEMENT/FLYASH
LDR STANDARD
NICKEL, TCLP (mg/l)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
6
7
8
9
10
11
12
13
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

ATTACHMENT F-4

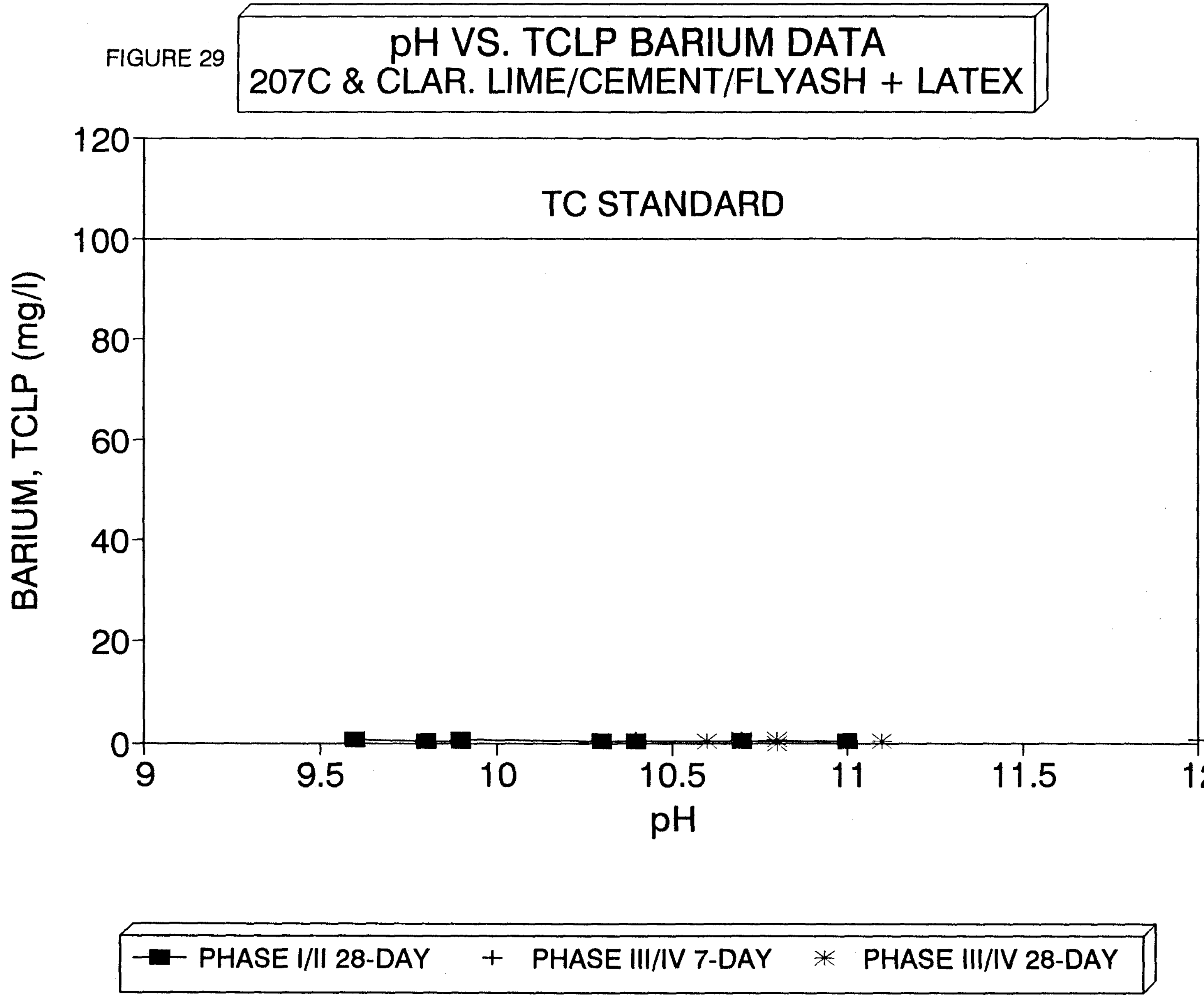
GROUP IV
POND 207C AND CLARIFIER
LIME/CEMENT/FLYASH PLUS LATEX

FIGURE 28



pH VS. TCLP ARSENIC DATA
207C & CLAR. LIME/CEMENT/FLYASH + LATEX
TC STANDARD
ARSENIC, TCLP (mg/l)
0
1
2
3
4
5
6
9
9.5
10
10.5
11
11.5
12
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 29



pH VS. TCLP BARIUM DATA
207C & CLAR. LIME/CEMENT/FLYASH + LATEX
TC STANDARD
BARIUM, TCLP (mg/l)
120
100
80
60
40
20
0
9
9.5
10
10.5
11
11.5
12
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 30

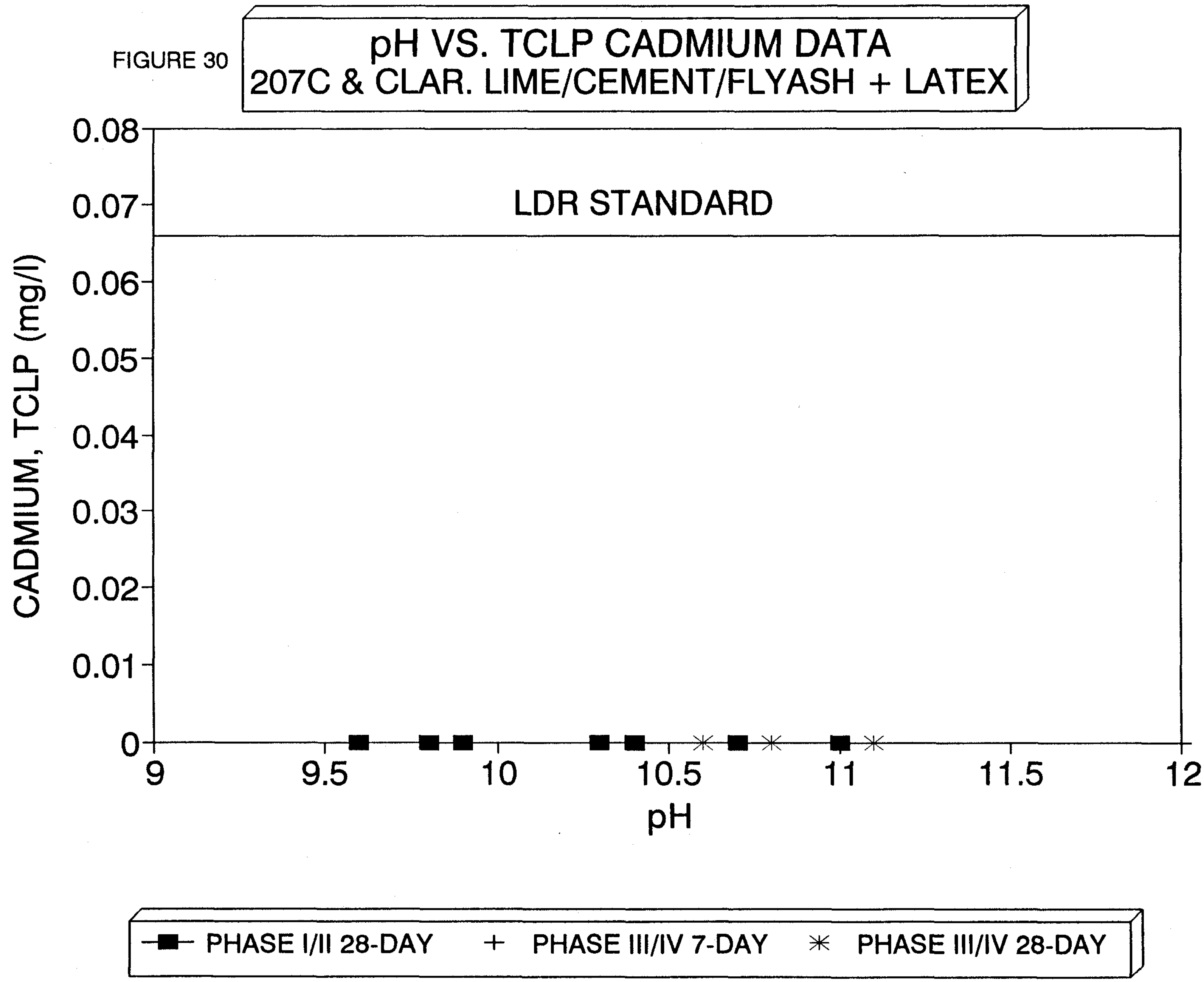

pH VS. TCLP CADMIUM DATA
207C & CLAR. LIME/CEMENT/FLYASH + LATEX
LDR STANDARD
CADMIUM, TCLP (mg/l)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
9
9.5
10
10.5
11
11.5
12
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 31

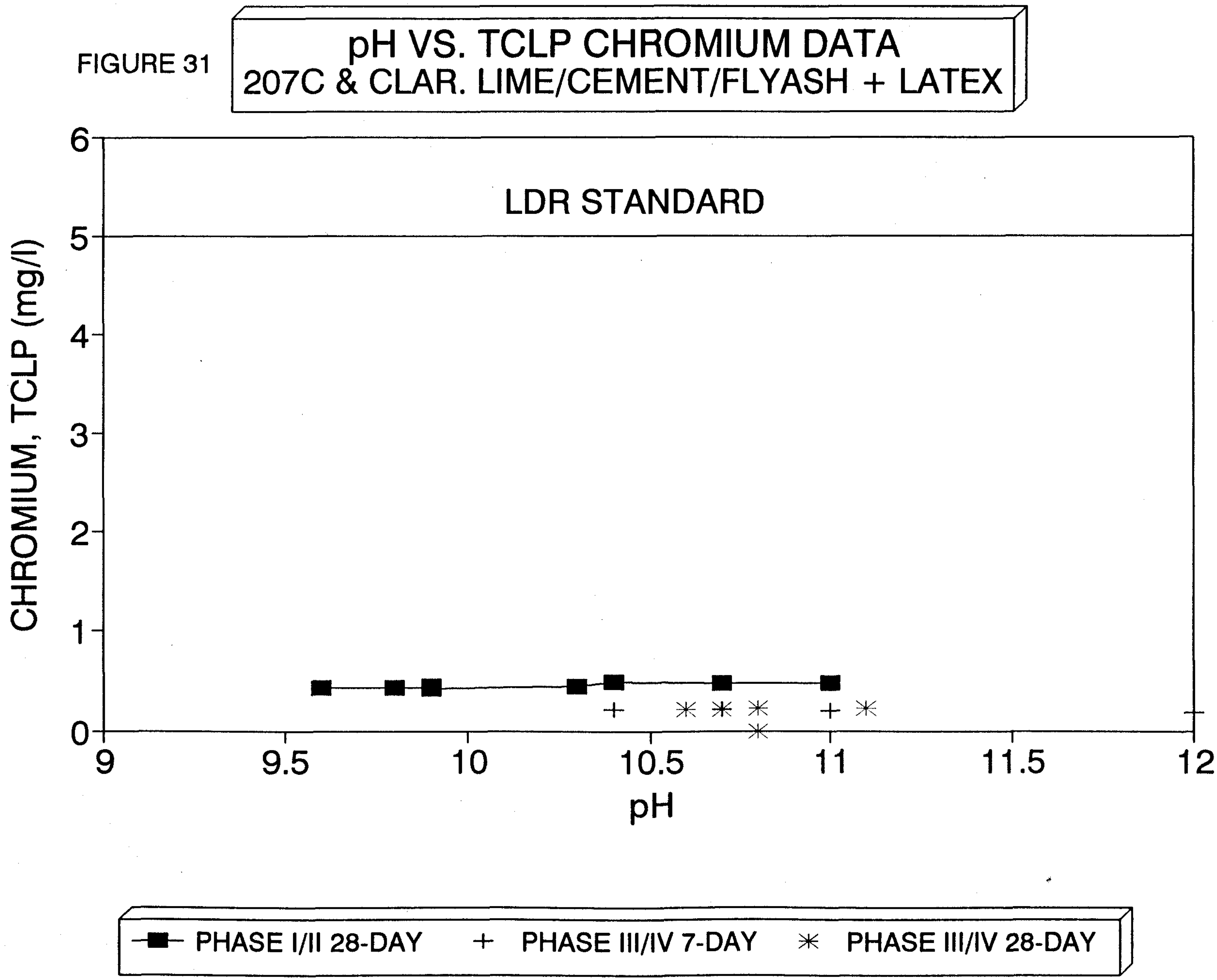

pH VS. TCLP CHROMIUM DATA
207C & CLAR. LIME/CEMENT/FLYASH + LATEX
LDR STANDARD
CHROMIUM, TCLP (mg/l)
0
1
2
3
4
5
6
pH
9
9.5
10
10.5
11
11.5
12
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 32

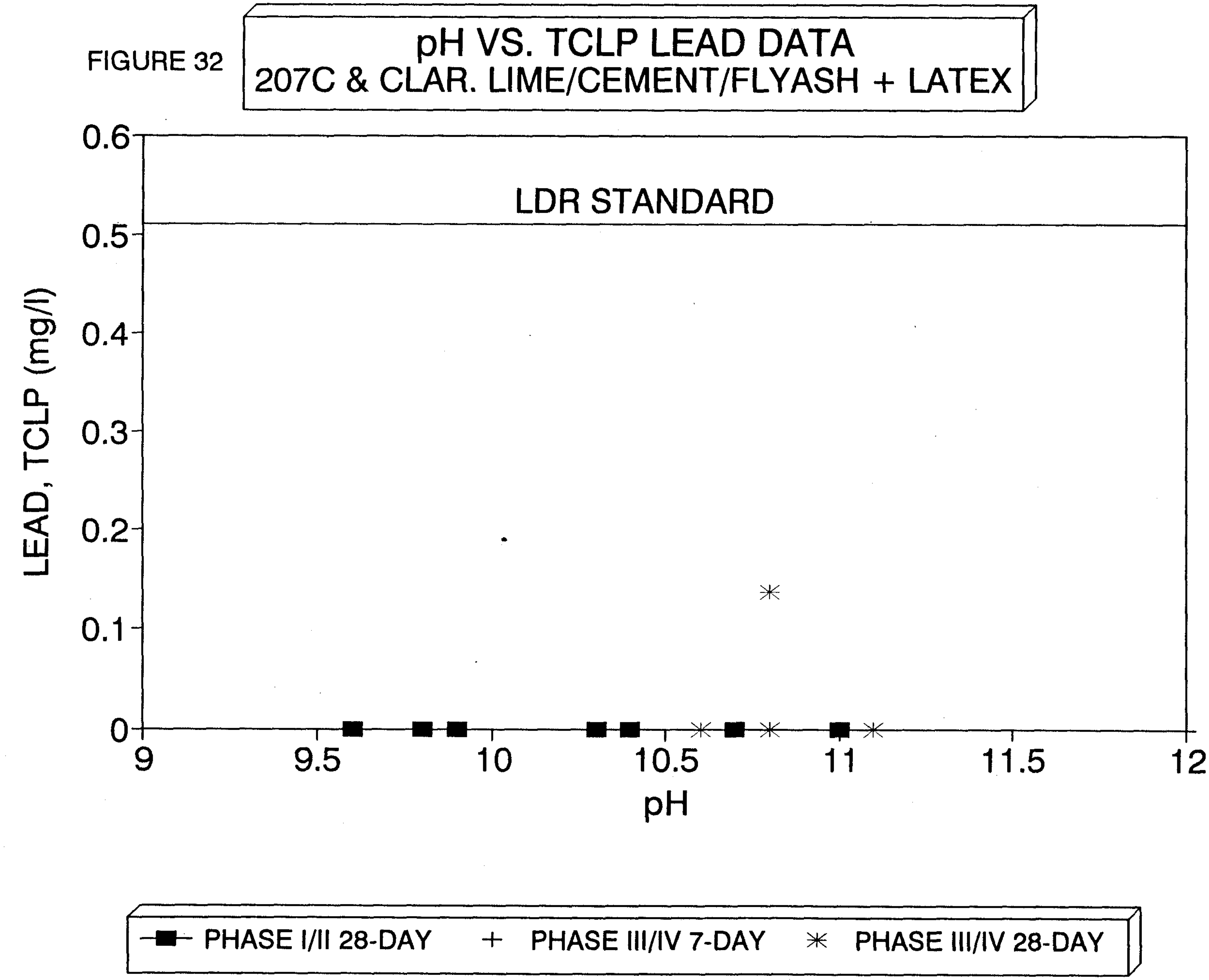

pH VS. TCLP LEAD DATA
207C & CLAR. LIME/CEMENT/FLYASH + LATEX
LDR STANDARD
LEAD, TCLP (mg/l)
0.6
0.5
0.4
0.3
0.2
0.1
0
9
9.5
10
10.5
11
11.5
12
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 33

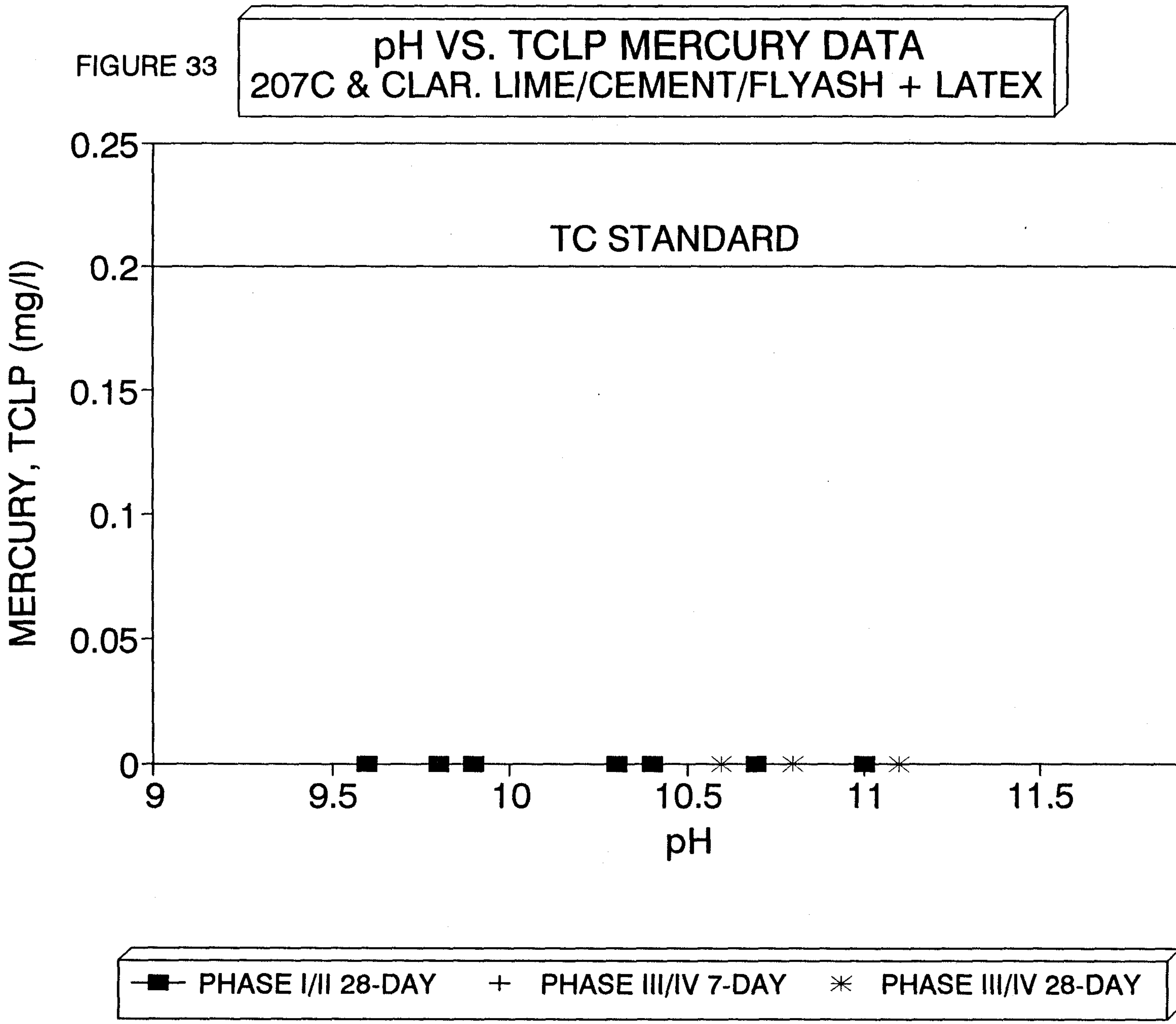
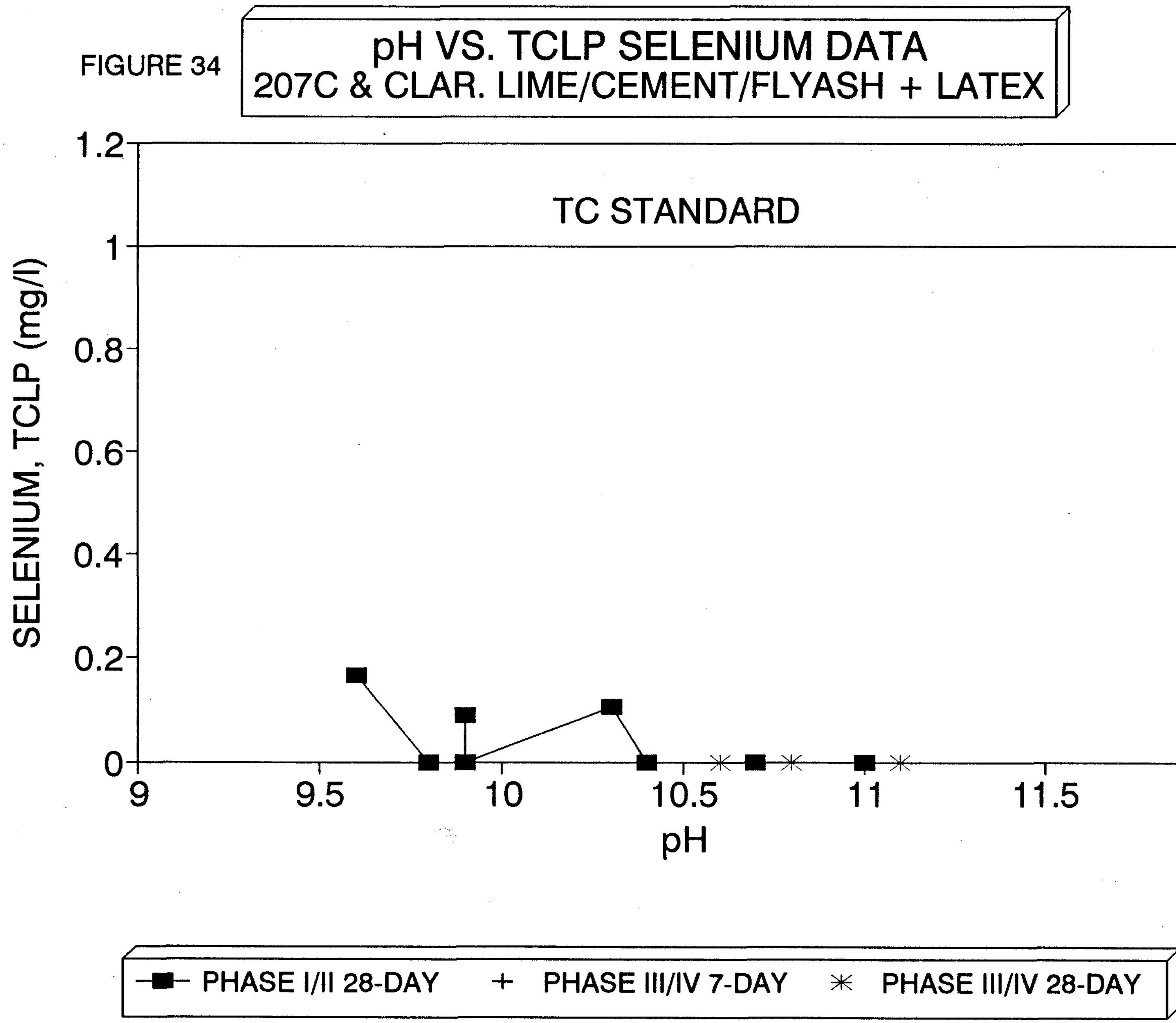
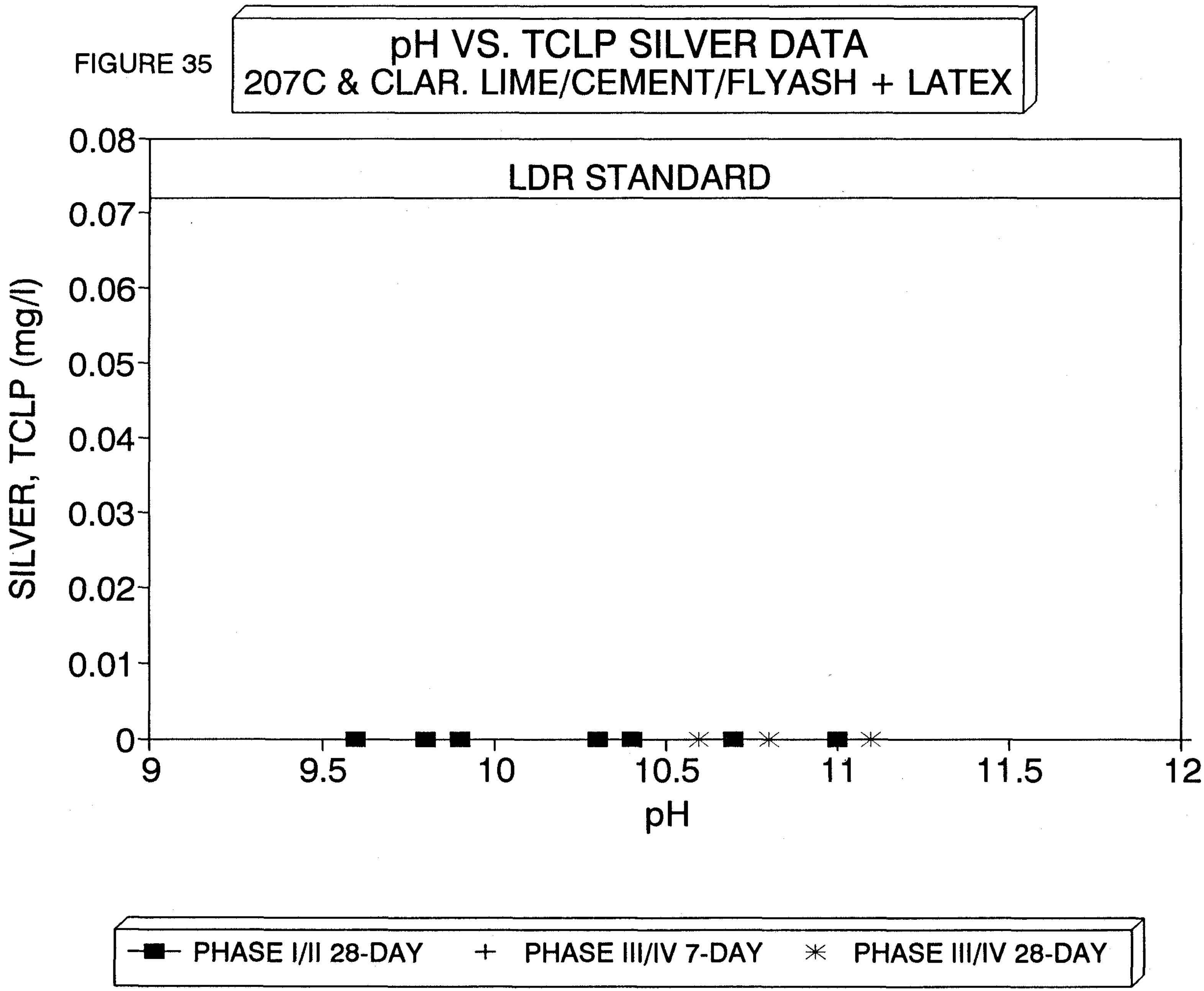

pH VS. TCLP MERCURY DATA
207C & CLAR. LIME/CEMENT/FLYASH + LATEX
TC STANDARD
MERCURY, TCLP (mg/l)
0.25
0.2
0.15
0.1
0.05
0
9
9.5
10
10.5
11
11.5
12
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 34



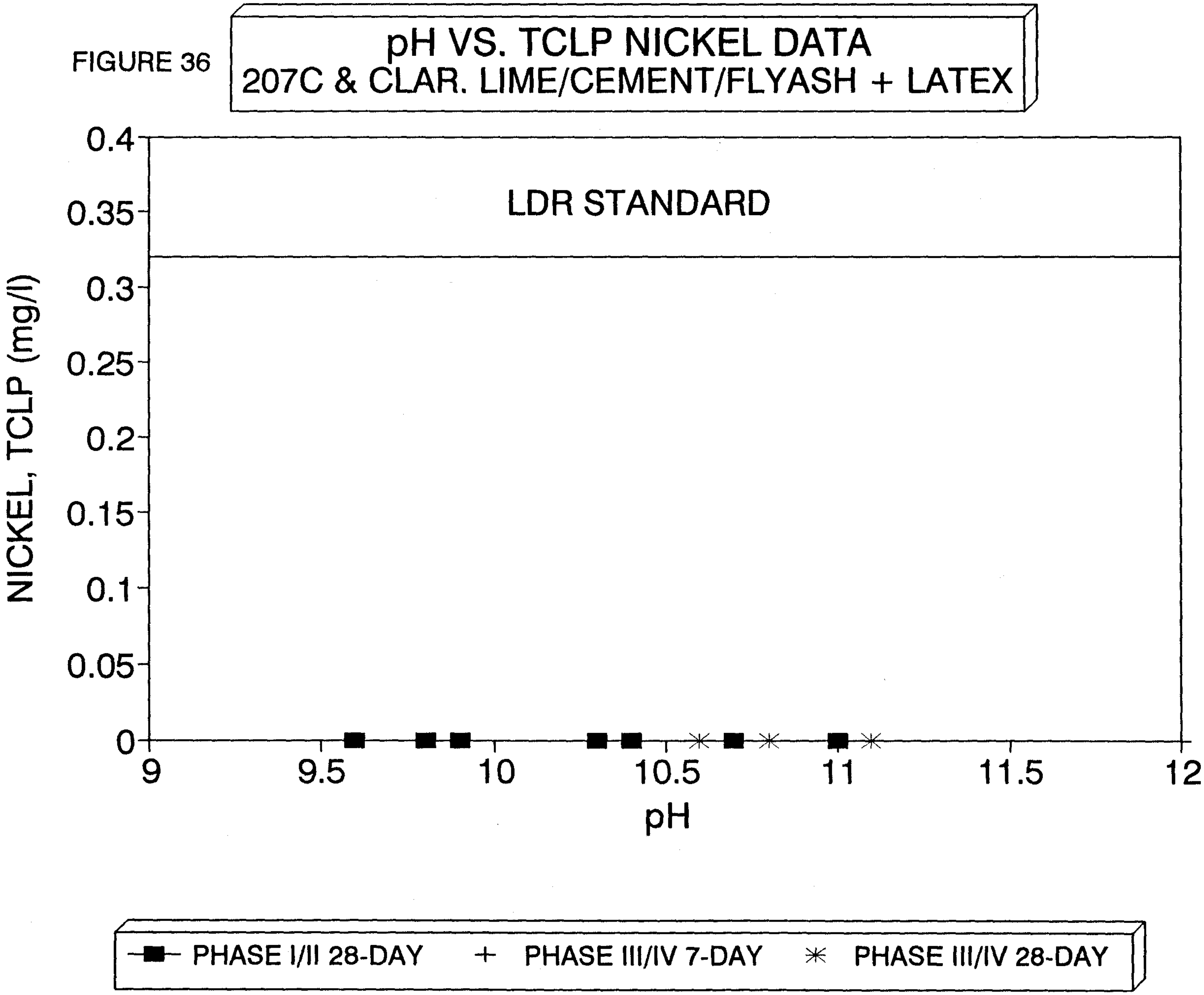
pH VS. TCLP SELENIUM DATA
207C & CLAR. LIME/CEMENT/FLYASH + LATEX
TC STANDARD
SELENIUM, TCLP (mg/l)
1.2
1
0.8
0.6
0.4
0.2
0
9
9.5
10
10.5
11
11.5
12
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 35



pH VS. TCLP SILVER DATA
207C & CLAR. LIME/CEMENT/FLYASH + LATEX
LDR STANDARD
SILVER, TCLP (mg/l)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
9
9.5
10
10.5
11
11.5
12
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

FIGURE 36


pH VS. TCLP NICKEL DATA
207C & CLAR. LIME/CEMENT/FLYASH + LATEX
LDR STANDARD
NICKEL, TCLP (mg/l)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
9
9.5
10
10.5
11
11.5
12
pH
PHASE I/II 28-DAY
PHASE III/IV 7-DAY
PHASE III/IV 28-DAY

Halliburton NUS
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September 9, 1993

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Project

Mr. Thomas d. Beckman
Contract Technical Representative
Solar Ponds Remediation Program
EG&G Rocky Flats, Inc.
Building 080
P. O. Box 464
Golden, Colorado 80402-0464

Subject: ROCKY FLATS PLANT SOLAR EVAPORATION PONDS STABILIZATION PROJECT
[WBS 235 & 236 TREATABILITY STUDY REPORT AND PROCESS FORMULATION REPORT, POND 207C & CLARIFIER – HALLIBURTON NUS ROCKY FLATS]
APPENDIX G
RF-HED-93-0528

Dear Mr. Beckman:

Enclosed is APPENDIX G to REVISION 0 of the Treatability Study Report and Process Formulation Report for C Pond and Clarifier Waste. This appendix documents the mathematical basis and derivation of the equations used in our density based control methodology. The equations in APPENDIX G supersede the equations in the main body of the Treatability Study Report.

Please add this appendix to your six copies of the basic document. If you have any questions or comments, please advise.

Sincerely,

HALLIBURTON NUS CORPORATION

John Schmidt
John A. Schmidt
Deputy Project Manager

JAS/jg

Enclosures: (APPENDIX G – TREATABILITY STUDY REPORT & PROCESS FORMULATION REPORT FOR C POND & CLARIFIER WASTE)

cc: T. Bittner
F. Lang

A:\LTR\BECKMAN70
RF-HED-93-0528

Received 8 - 10 - 93

Halliburton NUS
CORPORATION

INTERNAL CORRESPONDENCE

To: Ted Bittner

From: Shaj Mathew

Date: September 7, 1993

Doc. No.: RF-HEH-93-030

Subject: **APPENDIX G (REV. 0) OF TREATABILITY STUDY**

The 207C/Clarifier Stabilization Process will be performed using a density based control methodology. Using this methodology, the specific gravity of the output product is controlled to a set-point which will be calculated based on the input slurry specific gravity and that of the pozzolan mix required to produce an output product at a pre-determined water to pozzolan ratio.

Mathematical equations have been developed to simplify the calculation of the output slurry specific gravity set-point within the operating window defined by the treatability study. The error in these equations have been quantified as has been the capability of the Halliburton RCM Process control to maintain a product at a consistent specific gravity. The error analysis methodology was verified and approved by EG&G.

This document includes the mathematical basis and derivation of the equations, quantification of the mathematical and process control errors and defines the allowable processing window.

There are three major equations that are derived in this document. Equations 1 and 2 concern the processing of Pond 207C waste. Equation 1 calculates the output slurry specific gravity from the input slurry specific gravity using three variables. Equation 2 calculates the output slurry specific gravity from the input slurry specific gravity using two variables. Equation 3 calculates the output slurry specific gravity from the input slurry specific gravity for the mixed 207C/Clarifier waste.

This revision supercedes the draft form of this document which was published in March 1993. The revision includes the newly derived Equation 3 which was not part of the earlier document. In addition, the equations derived in Appendix G also supercedes the equations in the body of the Treatability Study Report. The new equations use a slightly different value for salt specific gravity and use polynomial regression to produce better fits.

I BACKGROUND

Control of the 207C/Clarifier Stabilization Process is effected using a density-based control system. This is based on controlling the density of the output product slurry to a value calculated using the density of the input waste slurry and the pozzolanic additives. Both the output and input waste slurry specific gravities are calculated from the specific gravities of their components.

The equations which would convert the input slurry specific gravity to the output slurry specific gravity will be derived in the other sections of this appendix. The estimated mathematical error in these calculations is also quantified as part of this exercise.

This section provides the variables and constants used for the calculations and sample calculations of input slurry specific gravity and output slurry specific gravity.

Component specific gravity information

The following specific gravity data will be used for the derivation of the equations:

Apparent specific gravity of dissolved salt	=	3.251
Specific gravity of 207C silt	=	2.23
Specific gravity of Clarifier silt	=	2.73

Variables used

The variables used in deriving the equations are as follows:

A = The water to pozzolan ratio
B = Specific gravity of pozzolans
C = Specific gravity of input slurry
D = Clarifier silt as a percentage of total silt.

Sample algebraic calculation of input slurry specific gravity

The input slurry consists of dissolved salt, silt, and water. The specific gravity of the input waste slurry will be made up of the specific gravities of its components.

For instance, in a sample with the following mass fractions:

Mass fraction of Salt	=	20%
Mass fraction of Silt	=	10%
Mass fraction of Water	=	70%
Specific gravity of Salt	=	3.251
Specific gravity of Silt	=	2.23

For 100 gms of input slurry,

Mass of Salt	=	20gms
Mass of Silt	=	10gms
Mass of Water	=	70gms
Volume of Salt	=	$20 \div 3.251 = 6.1519$mls
Volume of Silt	=	$10 \div 2.23 = 4.4840$mls
Volume of Water	=	70mls
Total Mass	=	100gms
Total Volume	=	$6.1519 + 4.484 + 70 = 80.636$mls
Sp. gravity of input slurry	=	$100 \div 80.636 = 1.2401$SG units

Sample algebraic calculation of output slurry specific gravity

For the example used in the previous section,

Mass of input slurry	=	100gms
Volume of input slurry	=	80.636mls
Mass of water	=	70gms

Using pozzolans with a specific gravity of 2.9 and with a water to pozzolan ratio of 0.42,

Mass of pozzolans	=	$70 \div 0.42 = 166.66$gms
Volume of pozzolans	=	$166.66 \div 2.9 = 57.47$mls
Total mass of output slurry	=	$100 + 166.66 = 266.66$gms
Total volume of output slurry	=	$80.636 + 57.47 = 138.106$mls

Specific Gravity of output slurry = $266.66 \div 138.106 = 1.93$S.G. units

II DERIVATION OF EQUATION 1

Purpose

The purpose behind Equation 1 was to have one equation for Pond 207C waste processing, which could be used to calculate the output slurry specific gravity if the water to pozzolan ratio, the specific gravity of the pozzolans, and the input slurry specific gravity are known.

Derivation

The output slurry specific gravity and the input slurry specific gravity can be algebraically calculated as shown in Section I. This was performed for different scenarios of input slurry TDS and TSS.

For a given water to pozzolan ratio and a given pozzolan specific gravity, the input slurry specific gravity and the output slurry specific gravity were calculated. The TDS was varied from 0 to 40% (in increments of 1%) and the TSS was varied from 0 to 15% (in increments of 2.5%). This produced 147 different cases for which the input slurry specific gravity and the output slurry specific gravity were calculated.

A linear regression was performed on the resulting output slurry specific gravity versus the input slurry specific gravity. For each water to pozzolan ratio, this procedure was repeated for pozzolan specific gravities ranging from 2.6 to 3.4 in increments of 0.1.

The input slurry specific gravity and output slurry specific gravity values along with the results of the linear regression for a water to pozzolan ratio of 0.34 is shown in Table G-1.

Using the following symbols for the variables,

A = W/P Ratio
B = Specific Gravity of Pozzolans and
C = Specific Gravity of Input Slurry,

When Output Slurry Specific Gravity is plotted against Input Slurry Specific Gravity the data can be linearized to yield:

$$SG_{out}=mC+c \qquad \textbf{(1a)}$$

where ***m*** is the slope of the line and ***c*** is the y-intercept for the data set.
The linearization of the output slurry specific gravity versus the input slurry specific gravity was repeated for Pozzolan Specific Gravities (B) from 2.6 to 3.4 in increments of 0.1. The x-coefficients and y-intercepts of equation 1a, when plotted against the pozzolan specific gravity gave good straight line fits shown in Figs. G-1 and G-2. The lines shown in figures G-1 and G-2 also have x-coefficients and y-intercepts, thus

FIGURE G-1

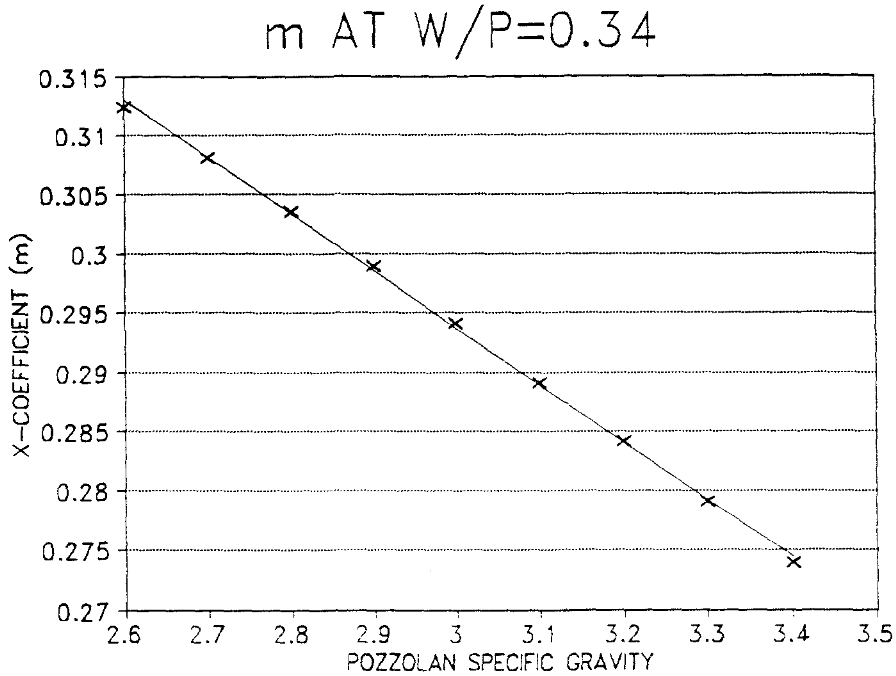
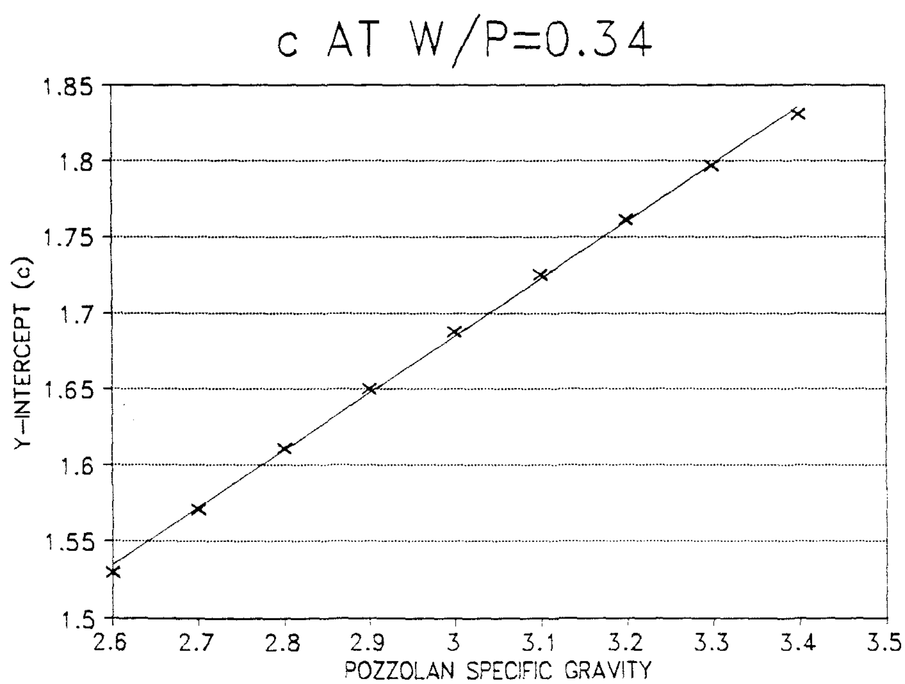


FIGURE G-2



For ***m*** vˢ ***B***,

$$m=m'mB+m'c \tag{1b}$$

where ***m'm*** and ***m'c*** are the slope and intercept of the line, respectively.

For ***c*** vs ***B***,

$$c=c'mB+c'c \tag{1c}$$

where ***c'm*** and ***c'c*** are the slope and intercept of the line respectively.

When 1b and 1c are incorporated into Equation 1a,

$$SG_{out}=(m'mB+m'c)C+c'mB+c'c \tag{1d}$$

The entire procedure was repeated for W/P Ratios (*A*) ranging from 0.34 to 0.50 in increments of 0.02.

The results are shown in Tables G-1 to G-9 and Figs. G-3 to G-6.

When ***m'm***, ***m'c***, ***c'm***, and ***c'c*** are plotted against the W/P ratios, the data can be represented best in the form of four equations - three linear and one trinomial:

$$m'm=0.10743982A-0.084269 \tag{1e}$$

$$m'c=0.35896237A+0.31719081 \tag{1f}$$

$$c'm=-0.65494A+0.594529 \tag{1g}$$

$$c'c=0.169365+2.23888A-4.03501A^2+2.348958A^3 \tag{1h}$$

These are shown in Table G-10 and the fitted lines can be seen in Figs. G-7 to G-10.

Substituting 1e, 1f, 1g, and 1h in 1d,

$$\boxed{\begin{aligned}SG_{out}=&0.10743982ABC-0.084269BC+0.35896237AC\\&+0.31719081C-0.65494AB+0.594529B\\&+0.169365+2.23888A-4.03501A^2+2.2348958A^3\end{aligned}} \tag{1}$$

This equation allows the calculation of the output slurry specific gravity if the input slurry specific gravity, pozzolan specific gravity and the water to pozzolan ratio are known for Pond 207C waste processing.

FIGURE G-3

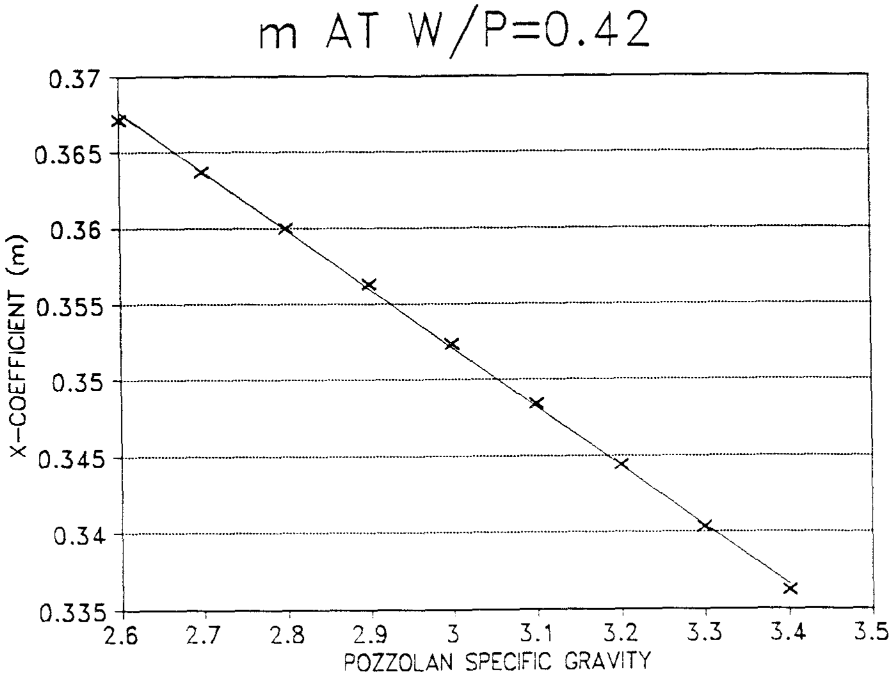


FIGURE G-4

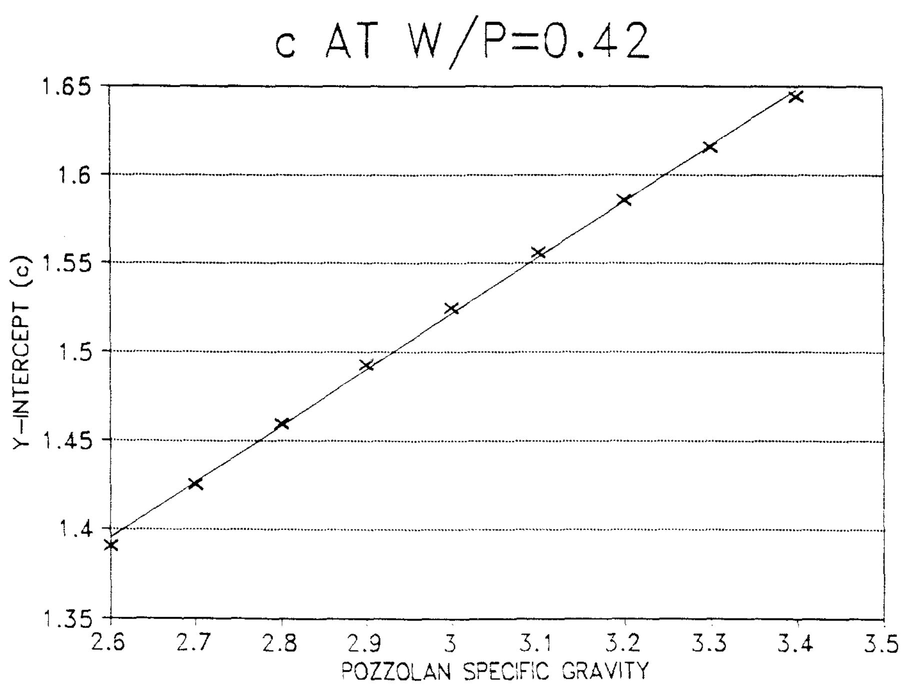


FIGURE G-5

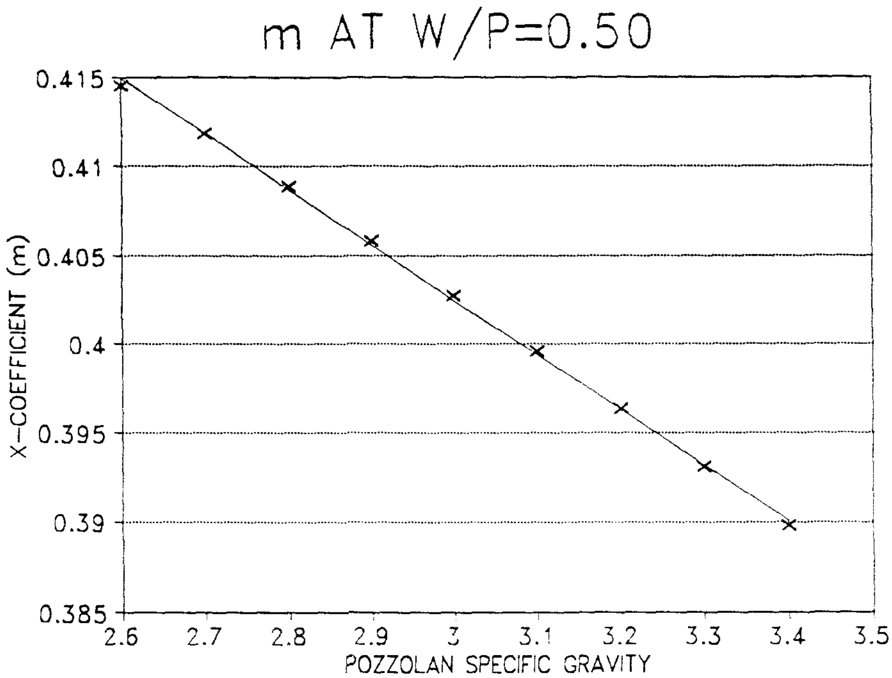


FIGURE G-6

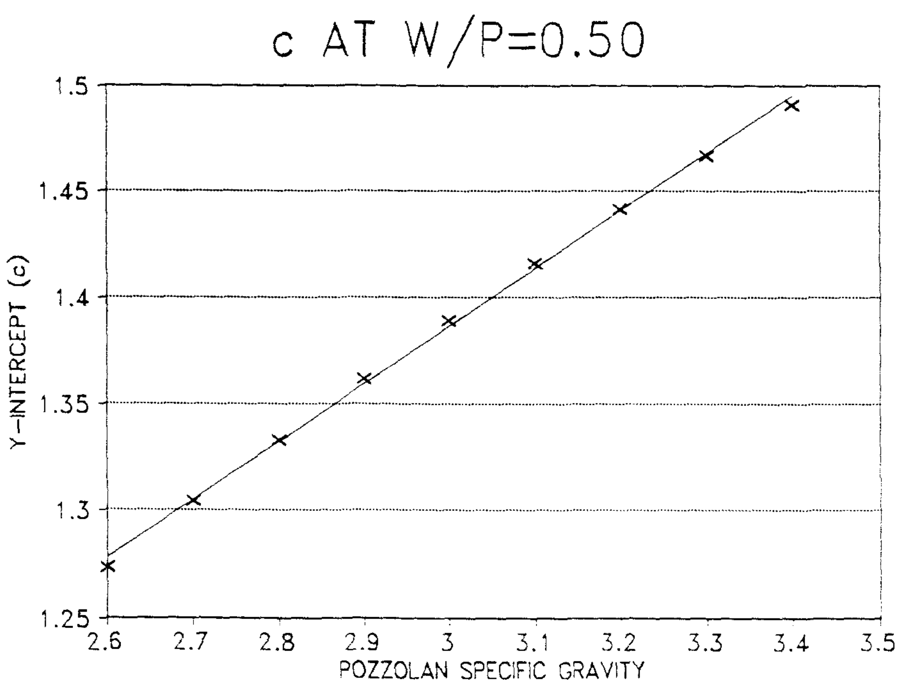


TABLE G-10

W/P	m'm	m'c	c'm	c'c
0.34	-0.0482419	0.43841894	0.37617744	0.556446
0.36	-0.045715	0.446264	0.359653	0.562042
0.38	-0.0432957	0.45387039	0.34427185	0.566388
0.4	-0.040986	0.461264	0.329931	0.569639
0.42	-0.0387863	0.46846476	0.31653964	0.571931
0.44	-0.036695	0.475489	0.304015	0.573381
0.46	-0.0347097	0.48235019	0.29228487	0.574093
0.48	-0.032827	0.489857	0.281282	0.574159
0.5	-0.0310417	0.49561675	0.27094733	0.57366

m'm Regression Output:			c'm Regression Output:		
Constant		-0.084269	Constant		0.594529
Std Err of Y Est		0.00035457	Std Err of Y Est		0.002919
R Squared		0.9968335	R Squared		0.994242
No. of Observations		9	No. of Observations		9
Degrees of Freedom		7	Degrees of Freedom		7
X Coefficient(s)	0.10743982		X Coefficient(s)	-0.65494	
Std Err of Coef.	0.00228873		Std Err of Coef.	0.018839	
m'c Regression Output:			c'c Polynomial Regression Output:		
Constant		0.31719081	Constant		0.169365
Std Err of Y Est		0.00061424	1 Degree Coefficient		2.23888
R Squared		0.99914671	2 Degree Coefficient		-4.03501
No. of Observations		9	3 Degree Coefficient		2.348958
Degrees of Freedom		7			
			Coefficient of Deteremination		0.999993
X Coefficient(s)	0.35896237		Coeffiicent of Correlation		0.999997
Std Err of Coef.	0.00396491		Standard Error of Estimate		2.1E-05

FIGURE G-7

LINEAR FIT OF m'm

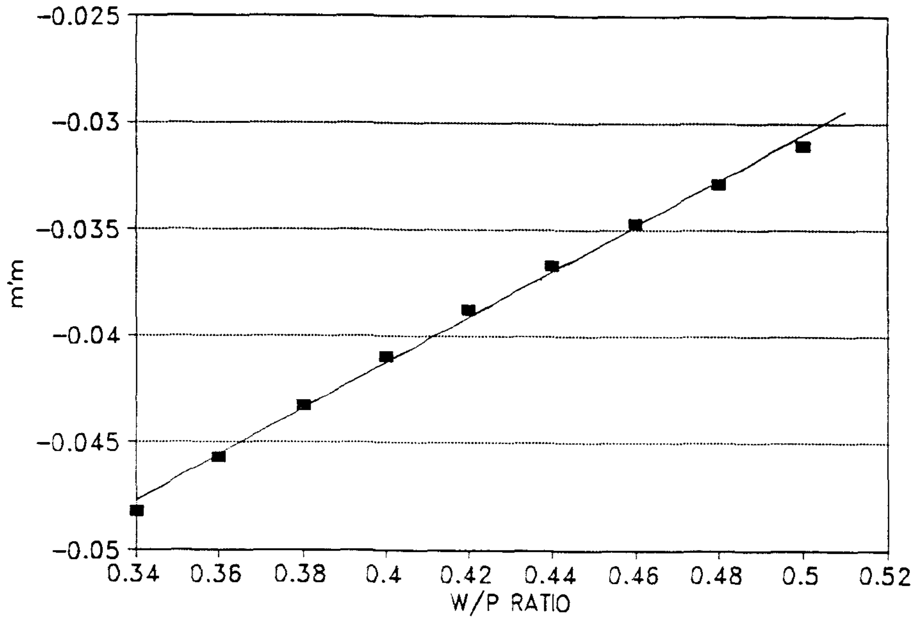


FIGURE G-8

LINEAR FIT OF m'c

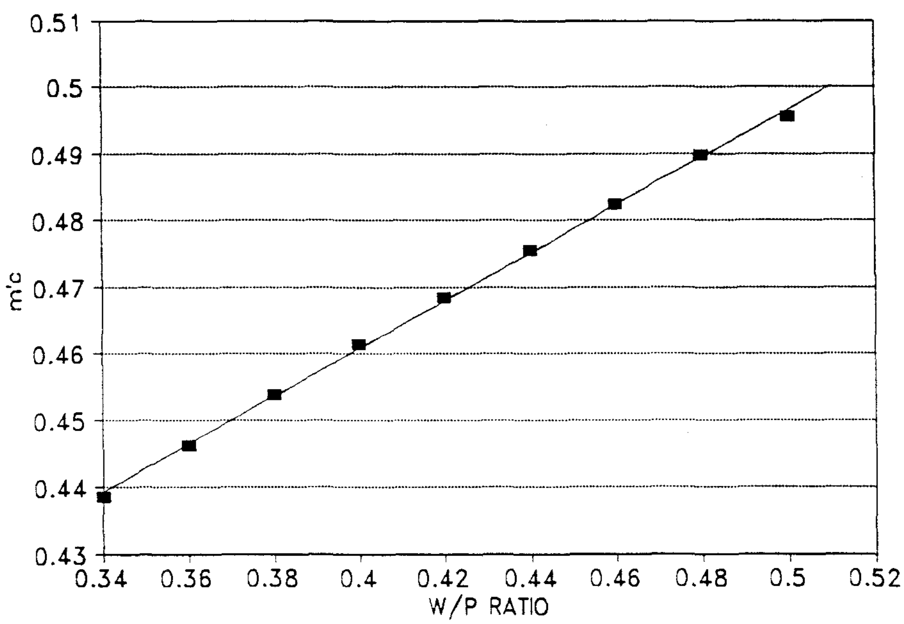


FIGURE G-9

LINEAR FIT OF c'm

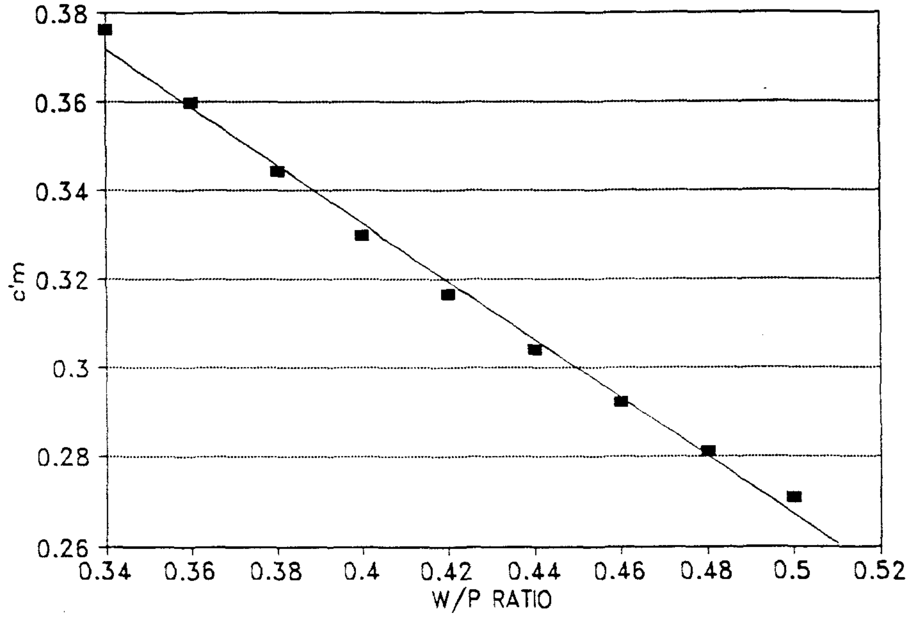
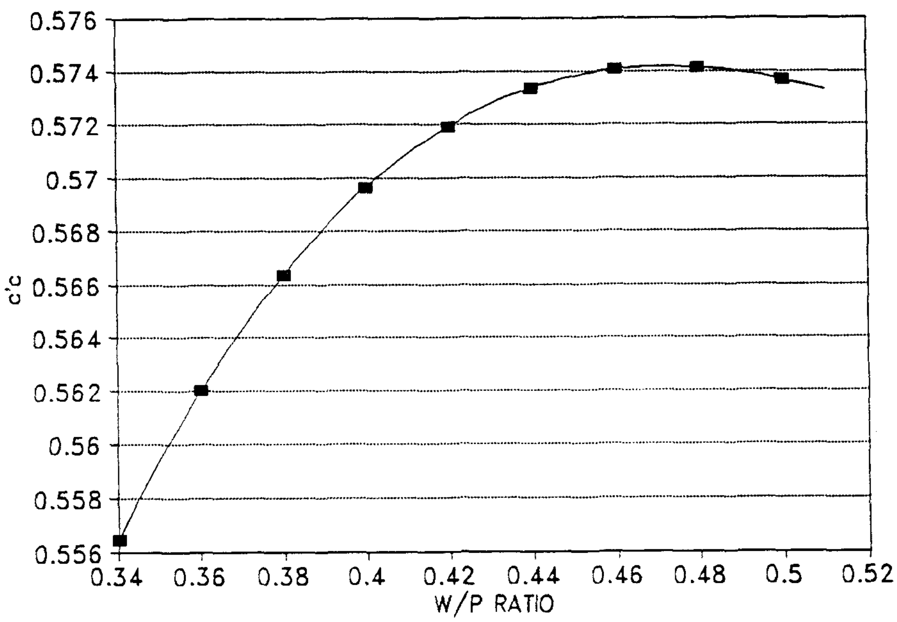


FIGURE G-10

POLYNOMIAL FIT OF c'c



III DERIVATION OF EQUATION 2

Purpose

Equation 1 allows us to calculate the output slurry specific gravity from the input slurry specific gravity for a range of W/P ratios for Pond 207C waste processing. In reality, the process will be controlled at a W/P ratio of 0.42. A simpler (Equation 2) was derived for this condition.

Derivation

Using the following symbols for variables,

B = Specific gravity of Pozzolans and
C = Specific gravity of Input Slurry.

When output slurry specific gravity is plotted against input slurry specific gravity and the data is linearized, for a pozzolan specific gravity of 2.6 and a W/P ratio of 0.42,

$$SG_{out}=0.3671524C+1.3903912 \tag{2a}$$

This was repeated for pozzolan specific gravities from 2.6 to 3.4. The x-coefficients and y-intercepts from these regressions are listed in Table G-11.

In the process of determining the best fit for this data set, it was determined that binomial fits worked better than linear fits. Both are shown in Table G-11. The fitted lines are shown in Figs. G-11 & G-12.

For ***m*** v^s ***B***,

$$m=0.4291364-0.0123718B-0.0044024B^2 \tag{2b}$$

For ***c*** v^s ***B***,

$$c=0.147656+0.6015001B-0.0474934B^2 \tag{2c}$$

Substituting (2b) and (2c) into (2a),

$$SG_{out} = 0.4291364C - 0.0123718BC - 0.004024B^2C + 0.147656 + 0.6015B - 0.0474934B^2 \quad (2)$$

This equation allows the calculation of the output slurry specific gravity knowing only the input slurry specific gravity and the pozzolan specific gravity for Pond 207C waste processing.

TABLE G-11

POZZOLAN SPECIFIC GRAVITY	X COEFF-ICIENT m	Y INTER-CEPT c
2.6	0.3671524	1.3903912
2.7	0.3636704	1.4255362
2.8	0.3600330	1.4596100
2.9	0.3562670	1.4926555
3.0	0.3523960	1.5247138
3.1	0.3484403	1.5558243
3.2	0.3444177	1.5860250
3.3	0.3403439	1.6153518
3.4	0.3362323	1.6438393

LINEAR REGRESSION OF X COEFFICIENT vS POZZ. SG

Regression Output:		
Constant		0.468465
Std Err of Y Est		0.000296
R Squared		0.999323
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	-0.038786	
Std Err of Coef.	0.000382	

POLY. REGRESSION OF X COEFFICIENT vS POZZ.

Regression Output:	
Constant	0.4291364
1 Degree Coefficient	-0.0123718
2 Degree Coefficient	-0.0044024
Coefficient of Determination	0.9999834
Coefficient of Correlation	0.9999917
Std Err of Estimate	4.99962E-05

LINEAR REGRESSION OF Y INTERCEPT vS POZZ. SG

Regression Output:		
Constant		0.571931
Std Err of Y Est		0.003152
R Squared		0.998845
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	0.316540	
Std Err of Coef.	0.004069	

POLY. REGRESSION OF Y COEFFICIENT vS POZZ.

Regression Output:	
Constant	0.1476560
1 Degree Coefficient	0.6015001
2 Degree Coefficient	-0.0474934
Coefficient of Determination	0.9999991
Coefficient of Correlation	0.9999995
Std Err of Estimate	9.9269968E-05

FIGURE G-11

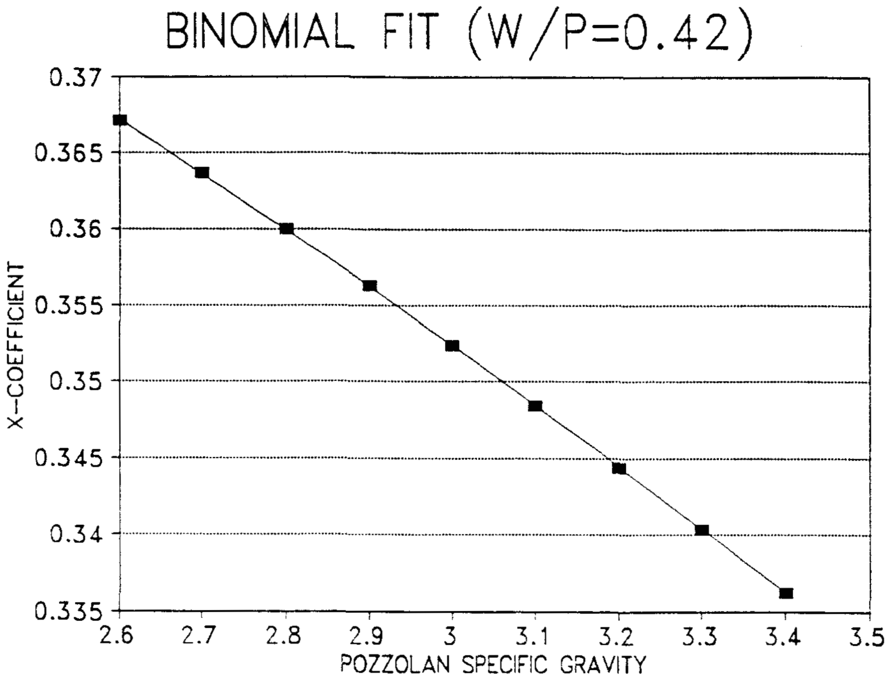
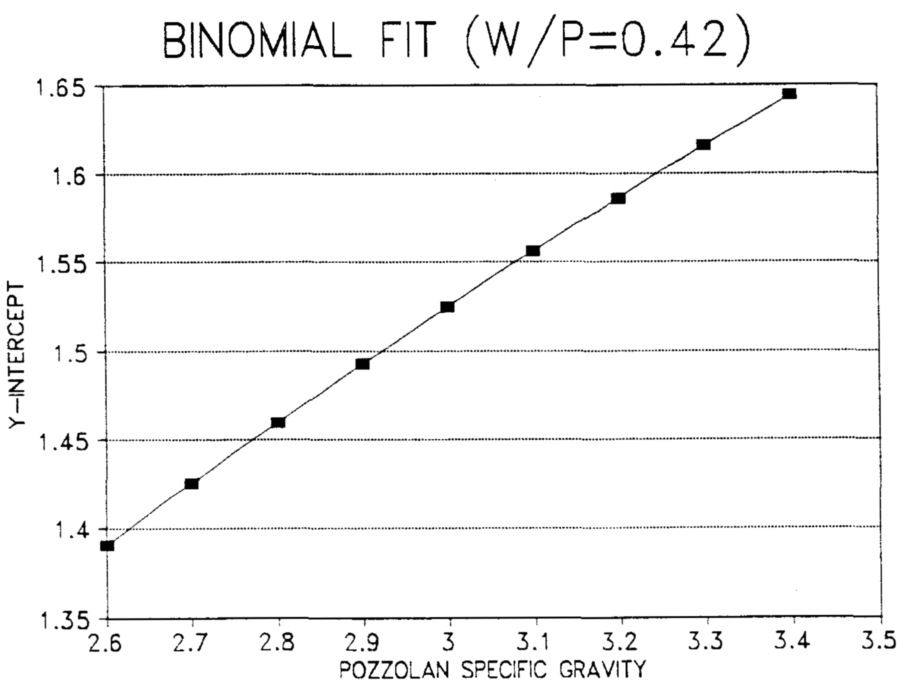


FIGURE G-12



IV ERROR IN EQUATION 1

The Halliburton RCM controls the specific gravity of the mix fairly close to the set point, Published literature by Halliburton put the value at ±0.15lbs/gal. (approximately ±0.01 SG units).

To study this, a sample run using a 8bbl. RCM and a 3" densometer was examined. Fig. G-13 shows the results with a lead density set point of 12.5 lbs/gal and a tail density set-point of 16.4 lbs/gal. In both cases, all the deviations were within ±0.1lbs/gal.

Thus the value of the process control error was chosen to be ±0.01 SG units which in addition to being the value published by Halliburton Services is 50% more conservative than that seen in the example described above which closely resembles the control scenario during processing.

Since Equation 1 is designed to be applicable to a wide range of processing scenarios, it cannot be expected to perfectly fit each of them. Therefore, it is necessary to define the error in the fit across the broad spectrum of processing scenarios.

To estimate the error of the math in Equation 1, the equation was tested for the entire range of input slurry specific gravity scenarios arising from different TDS and TSS combinations. The comparison was performed between the algebraic output slurry specific gravity and the output slurry specific gravity calculated by Equation 1 for each of these situations. The TDS was varied from 0 to 40% in increments of 1% and the TSS was varied from 0 to 15% in increments of 1%. This produced 656 different input waste scenarios.

The difference between the algebraic output slurry specific gravity and the Equation 1 output slurry specific gravity was calculated for each of the 656 situations. The results are shown in Table G-12. Fig. G-14 shows the weighted moving average of the output slurry specific gravities as a function of input slurry specific gravity.

When a frequency distribution of the deviations were performed, it could be seen that 100% of the deviations fell within 0.018 SG units of the algebraic output slurry specific gravity. This is graphically shown in Fig. G-15. However, the average deviation is within 0.006 SG units of the algebraic output slurry specific gravity.

Thus, under worst case conditions, the net cumulative error in the control of the output specific gravity would be ±0.028 SG units if Equation 1 is used in its computation.

FIGURE G-13

Density Control using 3 inch Densometer
Tkt. # 330636

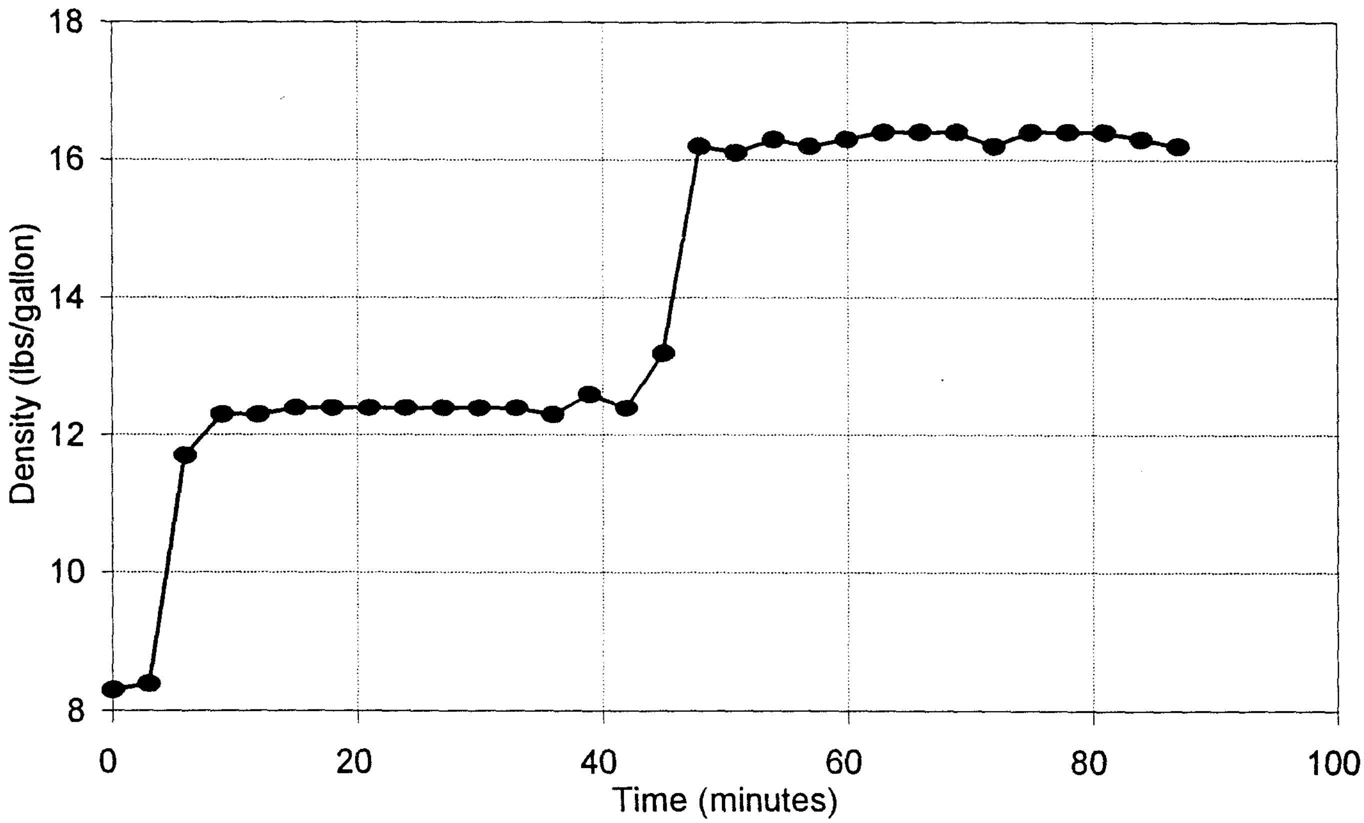
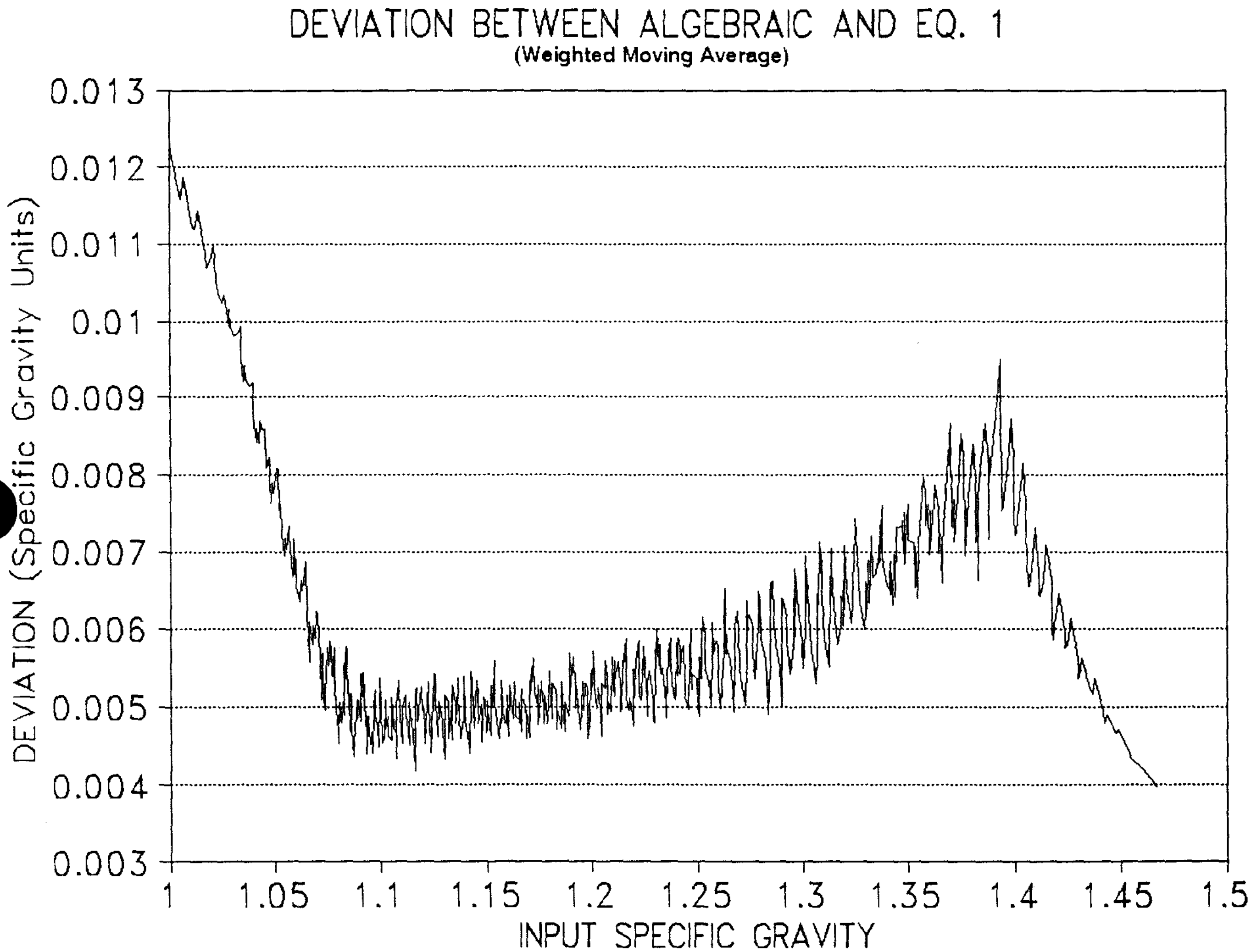


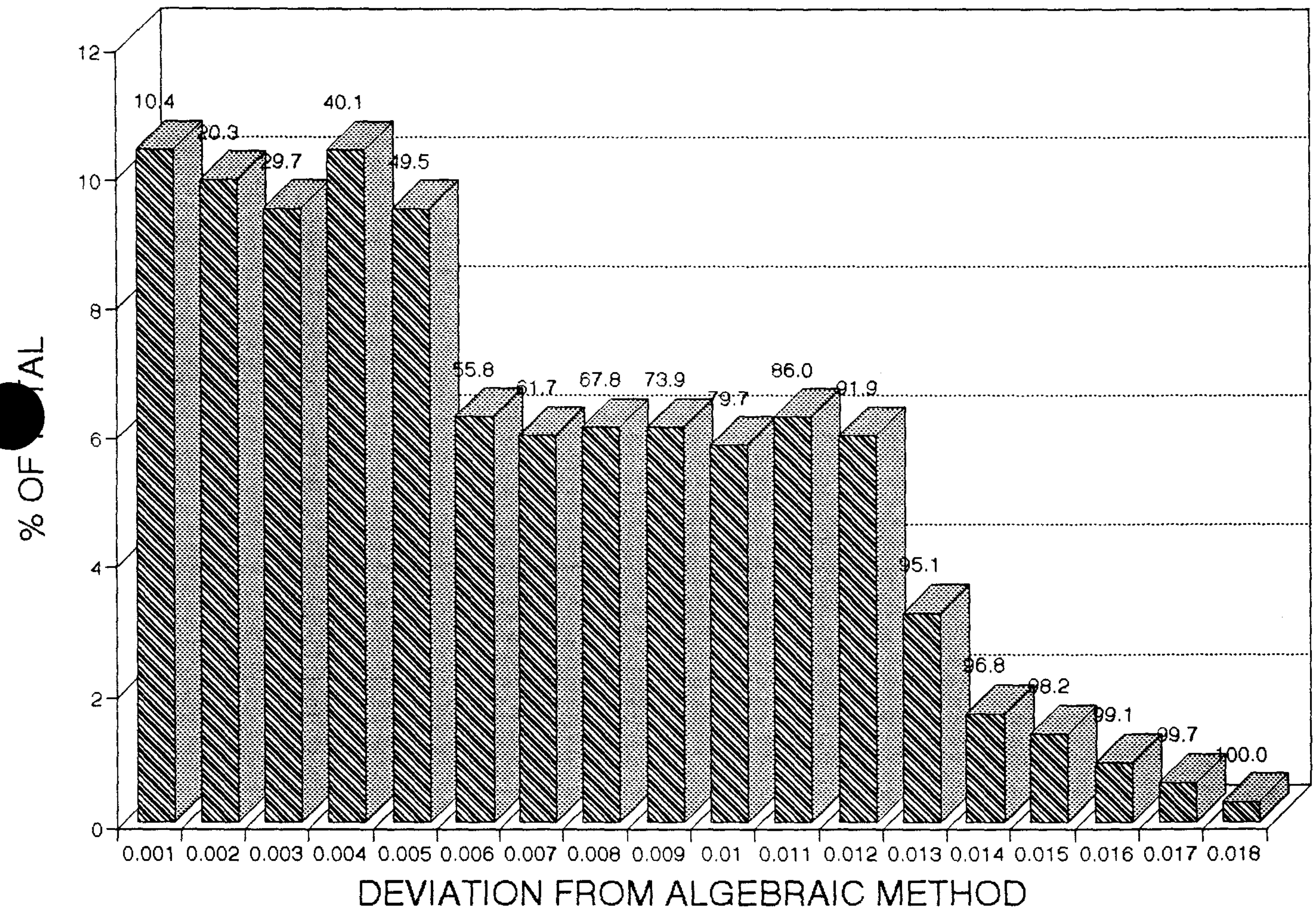
FIGURE G-14



DEVIATION BETWEEN ALGEBRAIC AND EQ. 1
(Weighted Moving Average)
0.013
0.012
0.011
0.01
0.009
0.008
0.007
0.006
0.005
0.004
0.003
DEVIATION (Specific Gravity Units)
1
1.05
1.1
1.15
1.2
1.25
1.3
1.35
1.4
1.45
1.5
INPUT SPECIFIC GRAVITY

FIGURE G-15

FREQUENCY DISTRIBUTION OF DEVIATIONS
IN SG OF EQUATION 1 FROM ALGEBRAIC



B.WQ1

TABLE G-12

DEVIATIONS BETWEEN ALGEBRAIC AND EQUATION 1

SPECIFIC GRAVITY OF POZZOLANS	2.900
SPECIFIC GRAVITY OF SALT	3.251
SPECIFIC GRAVITY OF SILT	2.23
W/P RATIO	0.42

TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	ALGEBRAIC OUTPUT SG	EQ 1 OUTPUT SG	DEVIATION
0	0	0.00	0	1.000	1.857	1.844	0.012
1	0	1.00	0	1.007	1.859	1.847	0.012
2	0	2.00	0	1.014	1.861	1.849	0.012
3	0	3.00	0	1.021	1.864	1.852	0.012
4	0	4.00	0	1.028	1.866	1.854	0.012
5	0	5.00	0	1.036	1.869	1.857	0.012
6	0	6.00	0	1.043	1.872	1.860	0.012
7	0	7.00	0	1.051	1.874	1.862	0.012
8	0	8.00	0	1.059	1.877	1.865	0.012
9	0	9.00	0	1.066	1.880	1.868	0.012
10	0	10.00	0	1.074	1.882	1.871	0.012
11	0	11.00	0	1.082	1.885	1.874	0.012
12	0	12.00	0	1.091	1.888	1.876	0.012
13	0	13.00	0	1.099	1.891	1.879	0.012
14	0	14.00	0	1.107	1.894	1.882	0.012
15	0	15.00	0	1.116	1.897	1.885	0.012
16	0	16.00	0	1.125	1.900	1.889	0.012
17	0	17.00	0	1.133	1.903	1.892	0.012
18	0	18.00	0	1.142	1.906	1.895	0.012
19	0	19.00	0	1.151	1.910	1.898	0.012
20	0	20.00	0	1.161	1.913	1.901	0.012
21	0	21.00	0	1.170	1.917	1.905	0.012
22	0	22.00	0	1.180	1.920	1.908	0.012
23	0	23.00	0	1.189	1.924	1.911	0.012
24	0	24.00	0	1.199	1.927	1.915	0.012
25	0	25.00	0	1.209	1.931	1.919	0.012
26	0	26.00	0	1.220	1.935	1.922	0.013
27	0	27.00	0	1.230	1.939	1.926	0.013
28	0	28.00	0	1.240	1.943	1.930	0.013
29	0	29.00	0	1.251	1.947	1.933	0.013
30	0	30.00	0	1.262	1.951	1.937	0.013
31	0	31.00	0	1.273	1.955	1.941	0.014
32	0	32.00	0	1.285	1.959	1.945	0.014
33	0	33.00	0	1.296	1.964	1.949	0.014
34	0	34.00	0	1.308	1.968	1.953	0.015
35	0	35.00	0	1.320	1.973	1.958	0.015

DEV 82-W92

TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	ALGEBRAIC OUTPUT SG	EQ 1 OUTPUT SG	DEVIATION
36	0	36.00	0	1.332	1.978	1.962	0.016
37	0	37.00	0	1.344	1.982	1.966	0.016
38	0	38.00	0	1.357	1.987	1.971	0.017
39	0	39.00	0	1.370	1.993	1.975	0.017
40	0	40.00	0	1.383	1.998	1.980	0.018
0	1	0.00	1	1.006	1.858	1.846	0.011
1	1	0.99	1	1.013	1.860	1.849	0.011
2	1	1.98	1	1.020	1.862	1.851	0.011
3	1	2.97	1	1.027	1.865	1.854	0.011
4	1	3.96	1	1.034	1.867	1.856	0.011
5	1	4.95	1	1.041	1.870	1.859	0.011
6	1	5.94	1	1.049	1.872	1.862	0.011
7	1	6.93	1	1.057	1.875	1.864	0.011
8	1	7.92	1	1.064	1.878	1.867	0.011
9	1	8.91	1	1.072	1.880	1.870	0.011
10	1	9.90	1	1.080	1.883	1.873	0.011
11	1	10.89	1	1.088	1.886	1.876	0.011
12	1	11.88	1	1.096	1.889	1.878	0.011
13	1	12.87	1	1.105	1.892	1.881	0.011
14	1	13.86	1	1.113	1.895	1.884	0.011
15	1	14.85	1	1.122	1.898	1.887	0.011
16	1	15.84	1	1.130	1.901	1.890	0.011
17	1	16.83	1	1.139	1.904	1.894	0.011
18	1	17.82	1	1.148	1.907	1.897	0.011
19	1	18.81	1	1.157	1.911	1.900	0.011
20	1	19.80	1	1.166	1.914	1.903	0.011
21	1	20.79	1	1.176	1.917	1.907	0.011
22	1	21.78	1	1.185	1.921	1.910	0.011
23	1	22.77	1	1.195	1.925	1.913	0.011
24	1	23.76	1	1.205	1.928	1.917	0.011
25	1	24.75	1	1.215	1.932	1.921	0.011
26	1	25.74	1	1.225	1.936	1.924	0.012
27	1	26.73	1	1.235	1.940	1.928	0.012
28	1	27.72	1	1.246	1.944	1.932	0.012
29	1	28.71	1	1.257	1.948	1.935	0.012
30	1	29.70	1	1.268	1.952	1.939	0.012
31	1	30.69	1	1.279	1.956	1.943	0.013
32	1	31.68	1	1.290	1.960	1.947	0.013
33	1	32.67	1	1.302	1.965	1.951	0.013
34	1	33.66	1	1.313	1.969	1.955	0.014
35	1	34.65	1	1.325	1.974	1.960	0.014
36	1	35.64	1	1.337	1.979	1.964	0.015
37	1	36.63	1	1.350	1.983	1.968	0.015

TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	ALGEBRAIC OUTPUT SG	EQ 1 OUTPUT SG	DEVIATION
38	1	37.62	1	1.362	1.988	1.973	0.016
39	1	38.61	1	1.375	1.993	1.977	0.016
40	1	39.60	1	1.388	1.999	1.982	0.017
0	2	0.00	2	1.011	1.858	1.848	0.010
1	2	0.98	2	1.018	1.861	1.851	0.010
2	2	1.96	2	1.025	1.863	1.853	0.010
3	2	2.94	2	1.032	1.866	1.856	0.010
4	2	3.92	2	1.040	1.868	1.858	0.010
5	2	4.90	2	1.047	1.871	1.861	0.010
6	2	5.88	2	1.055	1.873	1.864	0.010
7	2	6.86	2	1.062	1.876	1.866	0.010
8	2	7.84	2	1.070	1.879	1.869	0.010
9	2	8.82	2	1.078	1.881	1.872	0.010
10	2	9.80	2	1.086	1.884	1.875	0.010
11	2	10.78	2	1.094	1.887	1.878	0.009
12	2	11.76	2	1.102	1.890	1.880	0.009
13	2	12.74	2	1.110	1.893	1.883	0.009
14	2	13.72	2	1.119	1.896	1.886	0.009
15	2	14.70	2	1.127	1.899	1.889	0.009
16	2	15.68	2	1.136	1.902	1.893	0.009
17	2	16.66	2	1.145	1.905	1.896	0.010
18	2	17.64	2	1.154	1.908	1.899	0.010
19	2	18.62	2	1.163	1.912	1.902	0.010
20	2	19.60	2	1.172	1.915	1.905	0.010
21	2	20.58	2	1.181	1.918	1.909	0.010
22	2	21.56	2	1.191	1.922	1.912	0.010
23	2	22.54	2	1.201	1.925	1.915	0.010
24	2	23.52	2	1.210	1.929	1.919	0.010
25	2	24.50	2	1.221	1.933	1.923	0.010
26	2	25.48	2	1.231	1.937	1.926	0.011
27	2	26.46	2	1.241	1.940	1.930	0.011
28	2	27.44	2	1.252	1.944	1.934	0.011
29	2	28.42	2	1.262	1.948	1.937	0.011
30	2	29.40	2	1.273	1.953	1.941	0.011
31	2	30.38	2	1.284	1.957	1.945	0.012
32	2	31.36	2	1.296	1.961	1.949	0.012
33	2	32.34	2	1.307	1.966	1.953	0.012
34	2	33.32	2	1.319	1.970	1.957	0.013
35	2	34.30	2	1.331	1.975	1.962	0.013
36	2	35.28	2	1.343	1.979	1.966	0.014
37	2	36.26	2	1.355	1.984	1.970	0.014
38	2	37.24	2	1.368	1.989	1.975	0.015
39	2	38.22	2	1.381	1.994	1.979	0.015

TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	ALGEBRAIC OUTPUT SG	EQ 1 OUTPUT SG	DEVIATION
40	2	39.20	2	1.394	1.999	1.984	0.016
0	3	0.00	3	1.017	1.859	1.850	0.009
1	3	0.97	3	1.024	1.862	1.853	0.009
2	3	1.94	3	1.031	1.864	1.855	0.009
3	3	2.91	3	1.038	1.867	1.858	0.009
4	3	3.88	3	1.045	1.869	1.860	0.009
5	3	4.85	3	1.053	1.872	1.863	0.009
6	3	5.82	3	1.060	1.874	1.866	0.009
7	3	6.79	3	1.068	1.877	1.868	0.009
8	3	7.76	3	1.076	1.880	1.871	0.009
9	3	8.73	3	1.083	1.882	1.874	0.008
10	3	9.70	3	1.091	1.885	1.877	0.008
11	3	10.67	3	1.099	1.888	1.880	0.008
12	3	11.64	3	1.108	1.891	1.882	0.008
13	3	12.61	3	1.116	1.894	1.885	0.008
14	3	13.58	3	1.124	1.897	1.888	0.008
15	3	14.55	3	1.133	1.900	1.891	0.008
16	3	15.52	3	1.142	1.903	1.895	0.008
17	3	16.49	3	1.150	1.906	1.898	0.008
18	3	17.46	3	1.159	1.909	1.901	0.009
19	3	18.43	3	1.168	1.913	1.904	0.009
20	3	19.40	3	1.178	1.916	1.907	0.009
21	3	20.37	3	1.187	1.919	1.911	0.009
22	3	21.34	3	1.197	1.923	1.914	0.009
23	3	22.31	3	1.206	1.926	1.917	0.009
24	3	23.28	3	1.216	1.930	1.921	0.009
25	3	24.25	3	1.226	1.934	1.925	0.009
26	3	25.22	3	1.236	1.938	1.928	0.009
27	3	26.19	3	1.247	1.941	1.932	0.010
28	3	27.16	3	1.257	1.945	1.936	0.010
29	3	28.13	3	1.268	1.949	1.939	0.010
30	3	29.10	3	1.279	1.954	1.943	0.010
31	3	30.07	3	1.290	1.958	1.947	0.011
32	3	31.04	3	1.301	1.962	1.951	0.011
33	3	32.01	3	1.313	1.966	1.955	0.011
34	3	32.98	3	1.324	1.971	1.959	0.012
35	3	33.95	3	1.336	1.976	1.964	0.012
36	3	34.92	3	1.348	1.980	1.968	0.013
37	3	35.89	3	1.361	1.985	1.972	0.013
38	3	36.86	3	1.373	1.990	1.977	0.013
39	3	37.83	3	1.386	1.995	1.981	0.014
40	3	38.80	3	1.399	2.000	1.986	0.015
0	4	0.00	4	1.023	1.860	1.852	0.008

TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	ALGEBRAIC OUTPUT SG	EQ 1 OUTPUT SG	DEVIATION
1	4	0.96	4	1.030	1.863	1.855	0.008
2	4	1.92	4	1.037	1.865	1.857	0.008
3	4	2.88	4	1.044	1.868	1.860	0.008
4	4	3.84	4	1.051	1.870	1.862	0.008
5	4	4.80	4	1.059	1.873	1.865	0.008
6	4	5.76	4	1.066	1.875	1.868	0.008
7	4	6.72	4	1.074	1.878	1.870	0.008
8	4	7.68	4	1.081	1.881	1.873	0.007
9	4	8.64	4	1.089	1.883	1.876	0.007
10	4	9.60	4	1.097	1.886	1.879	0.007
11	4	10.56	4	1.105	1.889	1.882	0.007
12	4	11.52	4	1.113	1.892	1.885	0.007
13	4	12.48	4	1.122	1.895	1.887	0.007
14	4	13.44	4	1.130	1.898	1.890	0.007
15	4	14.40	4	1.139	1.901	1.893	0.007
16	4	15.36	4	1.147	1.904	1.897	0.007
17	4	16.32	4	1.156	1.907	1.900	0.007
18	4	17.28	4	1.165	1.910	1.903	0.007
19	4	18.24	4	1.174	1.914	1.906	0.008
20	4	19.20	4	1.183	1.917	1.909	0.008
21	4	20.16	4	1.193	1.920	1.913	0.008
22	4	21.12	4	1.202	1.924	1.916	0.008
23	4	22.08	4	1.212	1.927	1.920	0.008
24	4	23.04	4	1.222	1.931	1.923	0.008
25	4	24.00	4	1.232	1.935	1.927	0.008
26	4	24.96	4	1.242	1.939	1.930	0.008
27	4	25.92	4	1.252	1.942	1.934	0.009
28	4	26.88	4	1.263	1.946	1.938	0.009
29	4	27.84	4	1.274	1.950	1.941	0.009
30	4	28.80	4	1.284	1.955	1.945	0.009
31	4	29.76	4	1.296	1.959	1.949	0.010
32	4	30.72	4	1.307	1.963	1.953	0.010
33	4	31.68	4	1.318	1.967	1.957	0.010
34	4	32.64	4	1.330	1.972	1.961	0.011
35	4	33.60	4	1.342	1.977	1.965	0.011
36	4	34.56	4	1.354	1.981	1.970	0.011
37	4	35.52	4	1.366	1.986	1.974	0.012
38	4	36.48	4	1.379	1.991	1.979	0.012
39	4	37.44	4	1.391	1.996	1.983	0.013
40	4	38.40	4	1.404	2.001	1.988	0.014
0	5	0.00	5	1.028	1.861	1.854	0.007
1	5	0.95	5	1.035	1.864	1.857	0.007
2	5	1.90	5	1.042	1.866	1.859	0.007

TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	ALGEBRAIC OUTPUT SG	EQ 1 OUTPUT SG	DEVIATION
3	5	2.85	5	1.050	1.869	1.862	0.007
4	5	3.80	5	1.057	1.871	1.865	0.007
5	5	4.75	5	1.064	1.874	1.867	0.007
6	5	5.70	5	1.072	1.876	1.870	0.007
7	5	6.65	5	1.079	1.879	1.873	0.006
8	5	7.60	5	1.087	1.882	1.875	0.006
9	5	8.55	5	1.095	1.884	1.878	0.006
10	5	9.50	5	1.103	1.887	1.881	0.006
11	5	10.45	5	1.111	1.890	1.884	0.006
12	5	11.40	5	1.119	1.893	1.887	0.006
13	5	12.35	5	1.128	1.896	1.890	0.006
14	5	13.30	5	1.136	1.899	1.893	0.006
15	5	14.25	5	1.144	1.902	1.896	0.006
16	5	15.20	5	1.153	1.905	1.899	0.006
17	5	16.15	5	1.162	1.908	1.902	0.006
18	5	17.10	5	1.171	1.911	1.905	0.006
19	5	18.05	5	1.180	1.915	1.908	0.006
20	5	19.00	5	1.189	1.918	1.911	0.007
21	5	19.95	5	1.199	1.921	1.915	0.007
22	5	20.90	5	1.208	1.925	1.918	0.007
23	5	21.85	5	1.218	1.928	1.922	0.007
24	5	22.80	5	1.228	1.932	1.925	0.007
25	5	23.75	5	1.238	1.936	1.929	0.007
26	5	24.70	5	1.248	1.940	1.932	0.007
27	5	25.65	5	1.258	1.943	1.936	0.008
28	5	26.60	5	1.269	1.947	1.940	0.008
29	5	27.55	5	1.279	1.951	1.943	0.008
30	5	28.50	5	1.290	1.955	1.947	0.008
31	5	29.45	5	1.301	1.960	1.951	0.009
32	5	30.40	5	1.312	1.964	1.955	0.009
33	5	31.35	5	1.324	1.968	1.959	0.009
34	5	32.30	5	1.336	1.973	1.963	0.010
35	5	33.25	5	1.347	1.977	1.967	0.010
36	5	34.20	5	1.359	1.982	1.972	0.010
37	5	35.15	5	1.372	1.987	1.976	0.011
38	5	36.10	5	1.384	1.992	1.981	0.011
39	5	37.05	5	1.397	1.997	1.985	0.012
40	5	38.00	5	1.410	2.002	1.990	0.013
0	6	0.00	6	1.034	1.862	1.856	0.006
1	6	0.94	6	1.041	1.865	1.859	0.006
2	6	1.88	6	1.048	1.867	1.861	0.006
3	6	2.82	6	1.056	1.870	1.864	0.006
4	6	3.76	6	1.063	1.872	1.867	0.006

TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	ALGEBRAIC OUTPUT SG	EQ 1 OUTPUT SG	DEVIATION
5	6	4.70	6	1.070	1.875	1.869	0.005
6	6	5.64	6	1.078	1.877	1.872	0.005
7	6	6.58	6	1.085	1.880	1.875	0.005
8	6	7.52	6	1.093	1.883	1.877	0.005
9	6	8.46	6	1.101	1.885	1.880	0.005
10	6	9.40	6	1.109	1.888	1.883	0.005
11	6	10.34	6	1.117	1.891	1.886	0.005
12	6	11.28	6	1.125	1.894	1.889	0.005
13	6	12.22	6	1.133	1.897	1.892	0.005
14	6	13.16	6	1.142	1.900	1.895	0.005
15	6	14.10	6	1.150	1.903	1.898	0.005
16	6	15.04	6	1.159	1.906	1.901	0.005
17	6	15.98	6	1.168	1.909	1.904	0.005
18	6	16.92	6	1.177	1.912	1.907	0.005
19	6	17.86	6	1.186	1.916	1.910	0.005
20	6	18.80	6	1.195	1.919	1.914	0.005
21	6	19.74	6	1.204	1.922	1.917	0.006
22	6	20.68	6	1.214	1.926	1.920	0.006
23	6	21.62	6	1.224	1.929	1.924	0.006
24	6	22.56	6	1.234	1.933	1.927	0.006
25	6	23.50	6	1.243	1.937	1.931	0.006
26	6	24.44	6	1.254	1.941	1.934	0.006
27	6	25.38	6	1.264	1.944	1.938	0.007
28	6	26.32	6	1.274	1.948	1.942	0.007
29	6	27.26	6	1.285	1.952	1.945	0.007
30	6	28.20	6	1.296	1.956	1.949	0.007
31	6	29.14	6	1.307	1.961	1.953	0.008
32	6	30.08	6	1.318	1.965	1.957	0.008
33	6	31.02	6	1.330	1.969	1.961	0.008
34	6	31.96	6	1.341	1.974	1.965	0.009
35	6	32.90	6	1.353	1.978	1.969	0.009
36	6	33.84	6	1.365	1.983	1.974	0.009
37	6	34.78	6	1.377	1.988	1.978	0.010
38	6	35.72	6	1.390	1.993	1.982	0.010
39	6	36.66	6	1.402	1.998	1.987	0.011
40	6	37.60	6	1.415	2.003	1.992	0.012
0	7	0.00	7	1.040	1.863	1.859	0.005
1	7	0.93	7	1.047	1.866	1.861	0.005
2	7	1.86	7	1.054	1.868	1.864	0.005
3	7	2.79	7	1.061	1.871	1.866	0.005
4	7	3.72	7	1.069	1.873	1.869	0.004
5	7	4.65	7	1.076	1.876	1.871	0.004
6	7	5.58	7	1.084	1.878	1.874	0.004

TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	ALGEBRAIC OUTPUT SG	EQ 1 OUTPUT SG	DEVIATION
7	7	6.51	7	1.091	1.881	1.877	0.004
8	7	7.44	7	1.099	1.884	1.879	0.004
9	7	8.37	7	1.107	1.886	1.882	0.004
10	7	9.30	7	1.115	1.889	1.885	0.004
11	7	10.23	7	1.123	1.892	1.888	0.004
12	7	11.16	7	1.131	1.895	1.891	0.004
13	7	12.09	7	1.139	1.898	1.894	0.004
14	7	13.02	7	1.148	1.901	1.897	0.004
15	7	13.95	7	1.156	1.904	1.900	0.004
16	7	14.88	7	1.165	1.907	1.903	0.004
17	7	15.81	7	1.174	1.910	1.906	0.004
18	7	16.74	7	1.183	1.913	1.909	0.004
19	7	17.67	7	1.192	1.917	1.912	0.004
20	7	18.60	7	1.201	1.920	1.916	0.004
21	7	19.53	7	1.210	1.923	1.919	0.005
22	7	20.46	7	1.220	1.927	1.922	0.005
23	7	21.39	7	1.230	1.930	1.926	0.005
24	7	22.32	7	1.239	1.934	1.929	0.005
25	7	23.25	7	1.249	1.938	1.933	0.005
26	7	24.18	7	1.259	1.942	1.936	0.005
27	7	25.11	7	1.270	1.945	1.940	0.005
28	7	26.04	7	1.280	1.949	1.944	0.006
29	7	26.97	7	1.291	1.953	1.947	0.006
30	7	27.90	7	1.302	1.957	1.951	0.006
31	7	28.83	7	1.313	1.962	1.955	0.006
32	7	29.76	7	1.324	1.966	1.959	0.007
33	7	30.69	7	1.335	1.970	1.963	0.007
34	7	31.62	7	1.347	1.975	1.967	0.008
35	7	32.55	7	1.359	1.979	1.971	0.008
36	7	33.48	7	1.371	1.984	1.976	0.008
37	7	34.41	7	1.383	1.989	1.980	0.009
38	7	35.34	7	1.395	1.994	1.984	0.009
39	7	36.27	7	1.408	1.999	1.989	0.010
40	7	37.20	7	1.421	2.004	1.994	0.011
0	8	0.00	8	1.046	1.864	1.861	0.004
1	8	0.92	8	1.053	1.867	1.863	0.004
2	8	1.84	8	1.060	1.869	1.866	0.004
3	8	2.76	8	1.068	1.872	1.868	0.003
4	8	3.68	8	1.075	1.874	1.871	0.003
5	8	4.60	8	1.082	1.877	1.873	0.003
6	8	5.52	8	1.090	1.879	1.876	0.003
7	8	6.44	8	1.097	1.882	1.879	0.003
8	8	7.36	8	1.105	1.885	1.882	0.003

TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	ALGEBRAIC OUTPUT SG	EQ 1 OUTPUT SG	DEVIATION
9	8	8.28	8	1.113	1.887	1.884	0.003
10	8	9.20	8	1.121	1.890	1.887	0.003
11	8	10.12	8	1.129	1.893	1.890	0.003
12	8	11.04	8	1.137	1.896	1.893	0.003
13	8	11.96	8	1.145	1.899	1.896	0.003
14	8	12.88	8	1.154	1.902	1.899	0.003
15	8	13.80	8	1.162	1.905	1.902	0.003
16	8	14.72	8	1.171	1.908	1.905	0.003
17	8	15.64	8	1.180	1.911	1.908	0.003
18	8	16.56	8	1.189	1.914	1.911	0.003
19	8	17.48	8	1.198	1.918	1.914	0.003
20	8	18.40	8	1.207	1.921	1.918	0.003
21	8	19.32	8	1.216	1.924	1.921	0.003
22	8	20.24	8	1.226	1.928	1.924	0.004
23	8	21.16	8	1.236	1.932	1.928	0.004
24	8	22.08	8	1.245	1.935	1.931	0.004
25	8	23.00	8	1.255	1.939	1.935	0.004
26	8	23.92	8	1.265	1.943	1.938	0.004
27	8	24.84	8	1.276	1.946	1.942	0.004
28	8	25.76	8	1.286	1.950	1.946	0.005
29	8	26.68	8	1.297	1.954	1.950	0.005
30	8	27.60	8	1.308	1.958	1.953	0.005
31	8	28.52	8	1.319	1.963	1.957	0.005
32	8	29.44	8	1.330	1.967	1.961	0.006
33	8	30.36	8	1.341	1.971	1.965	0.006
34	8	31.28	8	1.353	1.976	1.969	0.006
35	8	32.20	8	1.364	1.980	1.974	0.007
36	8	33.12	8	1.376	1.985	1.978	0.007
37	8	34.04	8	1.389	1.990	1.982	0.008
38	8	34.96	8	1.401	1.995	1.986	0.008
39	8	35.88	8	1.414	2.000	1.991	0.009
40	8	36.80	8	1.426	2.005	1.995	0.009
0	9	0.00	9	1.052	1.866	1.863	0.003
1	9	0.91	9	1.059	1.868	1.865	0.003
2	9	1.82	9	1.066	1.870	1.868	0.002
3	9	2.73	9	1.074	1.873	1.870	0.002
4	9	3.64	9	1.081	1.875	1.873	0.002
5	9	4.55	9	1.088	1.878	1.876	0.002
6	9	5.46	9	1.096	1.880	1.878	0.002
7	9	6.37	9	1.103	1.883	1.881	0.002
8	9	7.28	9	1.111	1.886	1.884	0.002
9	9	8.19	9	1.119	1.889	1.887	0.002
10	9	9.10	9	1.127	1.891	1.889	0.002

TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	ALGEBRAIC OUTPUT SG	EQ 1 OUTPUT SG	DEVIATION
11	9	10.01	9	1.135	1.894	1.892	0.002
12	9	10.92	9	1.143	1.897	1.895	0.002
13	9	11.83	9	1.151	1.900	1.898	0.002
14	9	12.74	9	1.160	1.903	1.901	0.002
15	9	13.65	9	1.168	1.906	1.904	0.002
16	9	14.56	9	1.177	1.909	1.907	0.002
17	9	15.47	9	1.186	1.912	1.910	0.002
18	9	16.38	9	1.195	1.915	1.913	0.002
19	9	17.29	9	1.204	1.919	1.917	0.002
20	9	18.20	9	1.213	1.922	1.920	0.002
21	9	19.11	9	1.222	1.926	1.923	0.002
22	9	20.02	9	1.232	1.929	1.927	0.002
23	9	20.93	9	1.242	1.933	1.930	0.003
24	9	21.84	9	1.251	1.936	1.933	0.003
25	9	22.75	9	1.261	1.940	1.937	0.003
26	9	23.66	9	1.271	1.944	1.941	0.003
27	9	24.57	9	1.282	1.947	1.944	0.003
28	9	25.48	9	1.292	1.951	1.948	0.004
29	9	26.39	9	1.303	1.955	1.952	0.004
30	9	27.30	9	1.313	1.960	1.955	0.004
31	9	28.21	9	1.324	1.964	1.959	0.004
32	9	29.12	9	1.336	1.968	1.963	0.005
33	9	30.03	9	1.347	1.972	1.967	0.005
34	9	30.94	9	1.358	1.977	1.971	0.005
35	9	31.85	9	1.370	1.981	1.976	0.006
36	9	32.76	9	1.382	1.986	1.980	0.006
37	9	33.67	9	1.394	1.991	1.984	0.007
38	9	34.58	9	1.407	1.996	1.988	0.007
39	9	35.49	9	1.419	2.001	1.993	0.008
40	9	36.40	9	1.432	2.006	1.997	0.008
0	10	0.00	10	1.058	1.867	1.865	0.002
1	10	0.90	10	1.065	1.869	1.868	0.001
2	10	1.80	10	1.073	1.871	1.870	0.001
3	10	2.70	10	1.080	1.874	1.873	0.001
4	10	3.60	10	1.087	1.876	1.875	0.001
5	10	4.50	10	1.094	1.879	1.878	0.001
6	10	5.40	10	1.102	1.882	1.880	0.001
7	10	6.30	10	1.110	1.884	1.883	0.001
8	10	7.20	10	1.117	1.887	1.886	0.001
9	10	8.10	10	1.125	1.890	1.889	0.001
10	10	9.00	10	1.133	1.892	1.892	0.001
11	10	9.90	10	1.141	1.895	1.894	0.001
12	10	10.80	10	1.149	1.898	1.897	0.001

TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	ALGEBRAIC OUTPUT SG	EQ 1 OUTPUT SG	DEVIATION
13	10	11.70	10	1.158	1.901	1.900	0.001
14	10	12.60	10	1.166	1.904	1.903	0.001
15	10	13.50	10	1.175	1.907	1.906	0.001
16	10	14.40	10	1.183	1.910	1.909	0.001
17	10	15.30	10	1.192	1.913	1.912	0.001
18	10	16.20	10	1.201	1.917	1.916	0.001
19	10	17.10	10	1.210	1.920	1.919	0.001
20	10	18.00	10	1.219	1.923	1.922	0.001
21	10	18.90	10	1.229	1.927	1.925	0.001
22	10	19.80	10	1.238	1.930	1.929	0.001
23	10	20.70	10	1.248	1.934	1.932	0.002
24	10	21.60	10	1.257	1.937	1.936	0.002
25	10	22.50	10	1.267	1.941	1.939	0.002
26	10	23.40	10	1.277	1.945	1.943	0.002
27	10	24.30	10	1.288	1.949	1.946	0.002
28	10	25.20	10	1.298	1.952	1.950	0.002
29	10	26.10	10	1.309	1.956	1.954	0.003
30	10	27.00	10	1.319	1.961	1.958	0.003
31	10	27.90	10	1.330	1.965	1.961	0.003
32	10	28.80	10	1.342	1.969	1.965	0.004
33	10	29.70	10	1.353	1.973	1.969	0.004
34	10	30.60	10	1.364	1.978	1.973	0.004
35	10	31.50	10	1.376	1.982	1.978	0.005
36	10	32.40	10	1.388	1.987	1.982	0.005
37	10	33.30	10	1.400	1.992	1.986	0.006
38	10	34.20	10	1.412	1.997	1.991	0.006
39	10	35.10	10	1.425	2.002	1.995	0.007
40	10	36.00	10	1.438	2.007	1.999	0.007
0	11	0.00	11	1.065	1.868	1.867	0.000
1	11	0.89	11	1.072	1.870	1.870	0.000
2	11	1.78	11	1.079	1.872	1.872	0.000
3	11	2.67	11	1.086	1.875	1.875	0.000
4	11	3.56	11	1.093	1.877	1.877	0.000
5	11	4.45	11	1.101	1.880	1.880	0.000
6	11	5.34	11	1.108	1.883	1.883	0.000
7	11	6.23	11	1.116	1.885	1.885	0.000
8	11	7.12	11	1.124	1.888	1.888	0.000
9	11	8.01	11	1.131	1.891	1.891	0.000
10	11	8.90	11	1.139	1.893	1.894	0.000
11	11	9.79	11	1.147	1.896	1.897	0.000
12	11	10.68	11	1.156	1.899	1.899	0.000
13	11	11.57	11	1.164	1.902	1.902	0.000
14	11	12.46	11	1.172	1.905	1.905	0.000

TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	ALGEBRAIC OUTPUT SG	EQ 1 OUTPUT SG	DEVIATION
15	11	13.35	11	1.181	1.908	1.908	0.000
16	11	14.24	11	1.189	1.911	1.911	0.000
17	11	15.13	11	1.198	1.914	1.915	0.000
18	11	16.02	11	1.207	1.918	1.918	0.000
19	11	16.91	11	1.216	1.921	1.921	0.000
20	11	17.80	11	1.225	1.924	1.924	0.000
21	11	18.69	11	1.235	1.928	1.928	0.000
22	11	19.58	11	1.244	1.931	1.931	0.000
23	11	20.47	11	1.254	1.935	1.934	0.000
24	11	21.36	11	1.264	1.938	1.938	0.001
25	11	22.25	11	1.273	1.942	1.941	0.001
26	11	23.14	11	1.284	1.946	1.945	0.001
27	11	24.03	11	1.294	1.950	1.948	0.001
28	11	24.92	11	1.304	1.954	1.952	0.001
29	11	25.81	11	1.315	1.958	1.956	0.002
30	11	26.70	11	1.325	1.962	1.960	0.002
31	11	27.59	11	1.336	1.966	1.964	0.002
32	11	28.48	11	1.347	1.970	1.968	0.003
33	11	29.37	11	1.359	1.974	1.972	0.003
34	11	30.26	11	1.370	1.979	1.976	0.003
35	11	31.15	11	1.382	1.983	1.980	0.004
36	11	32.04	11	1.394	1.988	1.984	0.004
37	11	32.93	11	1.406	1.993	1.988	0.005
38	11	33.82	11	1.418	1.998	1.993	0.005
39	11	34.71	11	1.431	2.003	1.997	0.006
40	11	35.60	11	1.443	2.008	2.001	0.006
0	12	0.00	12	1.071	1.869	1.869	0.001
1	12	0.88	12	1.078	1.871	1.872	0.001
2	12	1.76	12	1.085	1.874	1.874	0.001
3	12	2.64	12	1.092	1.876	1.877	0.001
4	12	3.52	12	1.100	1.879	1.880	0.001
5	12	4.40	12	1.107	1.881	1.882	0.001
6	12	5.28	12	1.115	1.884	1.885	0.001
7	12	6.16	12	1.122	1.886	1.888	0.001
8	12	7.04	12	1.130	1.889	1.890	0.001
9	12	7.92	12	1.138	1.892	1.893	0.001
10	12	8.80	12	1.146	1.895	1.896	0.001
11	12	9.68	12	1.154	1.897	1.899	0.001
12	12	10.56	12	1.162	1.900	1.902	0.001
13	12	11.44	12	1.170	1.903	1.905	0.001
14	12	12.32	12	1.179	1.906	1.908	0.001
15	12	13.20	12	1.187	1.909	1.911	0.001
16	12	14.08	12	1.196	1.912	1.914	0.001

TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	ALGEBRAIC OUTPUT SG	EQ 1 OUTPUT SG	DEVIATION
17	12	14.96	12	1.204	1.916	1.917	0.001
18	12	15.84	12	1.213	1.919	1.920	0.001
19	12	16.72	12	1.222	1.922	1.923	0.001
20	12	17.60	12	1.232	1.925	1.926	0.001
21	12	18.48	12	1.241	1.929	1.930	0.001
22	12	19.36	12	1.250	1.932	1.933	0.001
23	12	20.24	12	1.260	1.936	1.936	0.001
24	12	21.12	12	1.270	1.939	1.940	0.001
25	12	22.00	12	1.280	1.943	1.943	0.000
26	12	22.88	12	1.290	1.947	1.947	0.000
27	12	23.76	12	1.300	1.951	1.951	0.000
28	12	24.64	12	1.310	1.955	1.954	0.000
29	12	25.52	12	1.321	1.959	1.958	0.001
30	12	26.40	12	1.332	1.963	1.962	0.001
31	12	27.28	12	1.342	1.967	1.966	0.001
32	12	28.16	12	1.353	1.971	1.970	0.002
33	12	29.04	12	1.365	1.976	1.974	0.002
34	12	29.92	12	1.376	1.980	1.978	0.002
35	12	30.80	12	1.388	1.985	1.982	0.003
36	12	31.68	12	1.400	1.989	1.986	0.003
37	12	32.56	12	1.412	1.994	1.990	0.004
38	12	33.44	12	1.424	1.999	1.995	0.004
39	12	34.32	12	1.436	2.004	1.999	0.005
40	12	35.20	12	1.449	2.009	2.004	0.005
0	13	0.00	13	1.077	1.870	1.872	0.002
1	13	0.87	13	1.084	1.872	1.874	0.002
2	13	1.74	13	1.091	1.875	1.877	0.002
3	13	2.61	13	1.099	1.877	1.879	0.002
4	13	3.48	13	1.106	1.880	1.882	0.002
5	13	4.35	13	1.113	1.882	1.885	0.002
6	13	5.22	13	1.121	1.885	1.887	0.002
7	13	6.09	13	1.129	1.888	1.890	0.002
8	13	6.96	13	1.136	1.890	1.893	0.002
9	13	7.83	13	1.144	1.893	1.895	0.002
10	13	8.70	13	1.152	1.896	1.898	0.002
11	13	9.57	13	1.160	1.899	1.901	0.003
12	13	10.44	13	1.168	1.901	1.904	0.003
13	13	11.31	13	1.176	1.904	1.907	0.003
14	13	12.18	13	1.185	1.907	1.910	0.003
15	13	13.05	13	1.193	1.910	1.913	0.002
16	13	13.92	13	1.202	1.914	1.916	0.002
17	13	14.79	13	1.211	1.917	1.919	0.002
18	13	15.66	13	1.220	1.920	1.922	0.002

TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	ALGEBRAIC OUTPUT SG	EQ 1 OUTPUT SG	DEVIATION
19	13	16.53	13	1.229	1.923	1.925	0.002
20	13	17.40	13	1.238	1.927	1.929	0.002
21	13	18.27	13	1.247	1.930	1.932	0.002
22	13	19.14	13	1.257	1.933	1.935	0.002
23	13	20.01	13	1.266	1.937	1.939	0.002
24	13	20.88	13	1.276	1.941	1.942	0.002
25	13	21.75	13	1.286	1.944	1.946	0.001
26	13	22.62	13	1.296	1.948	1.949	0.001
27	13	23.49	13	1.306	1.952	1.953	0.001
28	13	24.36	13	1.316	1.956	1.957	0.001
29	13	25.23	13	1.327	1.960	1.960	0.001
30	13	26.10	13	1.338	1.964	1.964	0.000
31	13	26.97	13	1.349	1.968	1.968	0.000
32	13	27.84	13	1.360	1.972	1.972	0.000
33	13	28.71	13	1.371	1.977	1.976	0.001
34	13	29.58	13	1.382	1.981	1.980	0.001
35	13	30.45	13	1.394	1.986	1.984	0.002
36	13	31.32	13	1.406	1.990	1.988	0.002
37	13	32.19	13	1.418	1.995	1.992	0.003
38	13	33.06	13	1.430	2.000	1.997	0.003
39	13	33.93	13	1.442	2.005	2.001	0.004
40	13	34.80	13	1.455	2.010	2.006	0.004
0	14	0.00	14	1.084	1.871	1.874	0.003
1	14	0.86	14	1.091	1.873	1.877	0.003
2	14	1.72	14	1.098	1.876	1.879	0.003
3	14	2.58	14	1.105	1.878	1.882	0.003
4	14	3.44	14	1.112	1.881	1.884	0.003
5	14	4.30	14	1.120	1.883	1.887	0.003
6	14	5.16	14	1.127	1.886	1.889	0.003
7	14	6.02	14	1.135	1.889	1.892	0.004
8	14	6.88	14	1.143	1.891	1.895	0.004
9	14	7.74	14	1.150	1.894	1.898	0.004
10	14	8.60	14	1.158	1.897	1.901	0.004
11	14	9.46	14	1.166	1.900	1.903	0.004
12	14	10.32	14	1.175	1.903	1.906	0.004
13	14	11.18	14	1.183	1.906	1.909	0.004
14	14	12.04	14	1.191	1.909	1.912	0.004
15	14	12.90	14	1.200	1.912	1.915	0.004
16	14	13.76	14	1.208	1.915	1.918	0.004
17	14	14.62	14	1.217	1.918	1.921	0.004
18	14	15.48	14	1.226	1.921	1.924	0.003
19	14	16.34	14	1.235	1.924	1.928	0.003
20	14	17.20	14	1.244	1.928	1.931	0.003

TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	ALGEBRAIC OUTPUT SG	EQ 1 OUTPUT SG	DEVIATION
21	14	18.06	14	1.254	1.931	1.934	0.003
22	14	18.92	14	1.263	1.935	1.938	0.003
23	14	19.78	14	1.273	1.938	1.941	0.003
24	14	20.64	14	1.282	1.942	1.944	0.003
25	14	21.50	14	1.292	1.945	1.948	0.003
26	14	22.36	14	1.302	1.949	1.951	0.002
27	14	23.22	14	1.312	1.953	1.955	0.002
28	14	24.08	14	1.323	1.957	1.959	0.002
29	14	24.94	14	1.333	1.961	1.962	0.002
30	14	25.80	14	1.344	1.965	1.966	0.001
31	14	26.66	14	1.355	1.969	1.970	0.001
32	14	27.52	14	1.366	1.973	1.974	0.001
33	14	28.38	14	1.377	1.978	1.978	0.000
34	14	29.24	14	1.388	1.982	1.982	0.000
35	14	30.10	14	1.400	1.987	1.986	0.001
36	14	30.96	14	1.412	1.991	1.990	0.001
37	14	31.82	14	1.424	1.996	1.994	0.002
38	14	32.68	14	1.436	2.001	1.999	0.002
39	14	33.54	14	1.448	2.006	2.003	0.003
40	14	34.40	14	1.461	2.011	2.008	0.003
0	15	0.00	15	1.090	1.872	1.876	0.004
1	15	0.85	15	1.097	1.875	1.879	0.004
2	15	1.70	15	1.104	1.877	1.881	0.004
3	15	2.55	15	1.112	1.879	1.884	0.004
4	15	3.40	15	1.119	1.882	1.886	0.004
5	15	4.25	15	1.126	1.885	1.889	0.005
6	15	5.10	15	1.134	1.887	1.892	0.005
7	15	5.95	15	1.141	1.890	1.894	0.005
8	15	6.80	15	1.149	1.893	1.897	0.005
9	15	7.65	15	1.157	1.895	1.900	0.005
10	15	8.50	15	1.165	1.898	1.903	0.005
11	15	9.35	15	1.173	1.901	1.906	0.005
12	15	10.20	15	1.181	1.904	1.909	0.005
13	15	11.05	15	1.189	1.907	1.911	0.005
14	15	11.90	15	1.198	1.910	1.914	0.005
15	15	12.75	15	1.206	1.913	1.917	0.005
16	15	13.60	15	1.215	1.916	1.921	0.005
17	15	14.45	15	1.224	1.919	1.924	0.005
18	15	15.30	15	1.233	1.922	1.927	0.005
19	15	16.15	15	1.242	1.925	1.930	0.004
20	15	17.00	15	1.251	1.929	1.933	0.004
21	15	17.85	15	1.260	1.932	1.936	0.004
22	15	18.70	15	1.269	1.936	1.940	0.004

TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	ALGEBRAIC OUTPUT SG	EQ 1 OUTPUT SG	DEVIATION
23	15	19.55	15	1.279	1.939	1.943	0.004
24	15	20.40	15	1.289	1.943	1.947	0.004
25	15	21.25	15	1.298	1.947	1.950	0.004
26	15	22.10	15	1.308	1.950	1.954	0.003
27	15	22.95	15	1.319	1.954	1.957	0.003
28	15	23.80	15	1.329	1.958	1.961	0.003
29	15	24.65	15	1.339	1.962	1.965	0.003
30	15	25.50	15	1.350	1.966	1.968	0.002
31	15	26.35	15	1.361	1.970	1.972	0.002
32	15	27.20	15	1.372	1.974	1.976	0.002
33	15	28.05	15	1.383	1.979	1.980	0.001
34	15	28.90	15	1.394	1.983	1.984	0.001
35	15	29.75	15	1.406	1.988	1.988	0.001
36	15	30.60	15	1.418	1.992	1.992	0.000
37	15	31.45	15	1.430	1.997	1.997	0.000
38	15	32.30	15	1.442	2.002	2.001	0.001
39	15	33.15	15	1.454	2.007	2.005	0.002
40	15	34.00	15	1.467	2.012	2.010	0.002

AVERAGE DEVIATION	0.006
MAXIMUM DEVIATION	0.018

V ERROR IN EQUATION 2

Since Equation 2 is designed to be applicable to a wide range of processing scenarios, it cannot be expected to perfectly fit each of them. Therefore, it is necessary to define the error in the fit across the broad spectrum of processing scenarios.

To estimate the error of the math in Equation 2, the equation was tested using the same method used to evaluate Equation 1. The comparison was performed between the algebraic output slurry specific gravity and the output slurry specific gravity calculated by Equation 2 for each of these situations. The TDS was varied from 0 to 40% in increments of 1% and the TSS was varied from 0 to 15% in increments of 1%. This produced 656 different input waste scenarios.

The difference between the algebraic output slurry specific gravity and the Equation 2 output slurry specific gravity was calculated for each of the 656 situations. The results are shown in Table G-13. Fig. G-16 shows the weighted moving average of the output slurry specific gravities as a function of input slurry specific gravity.

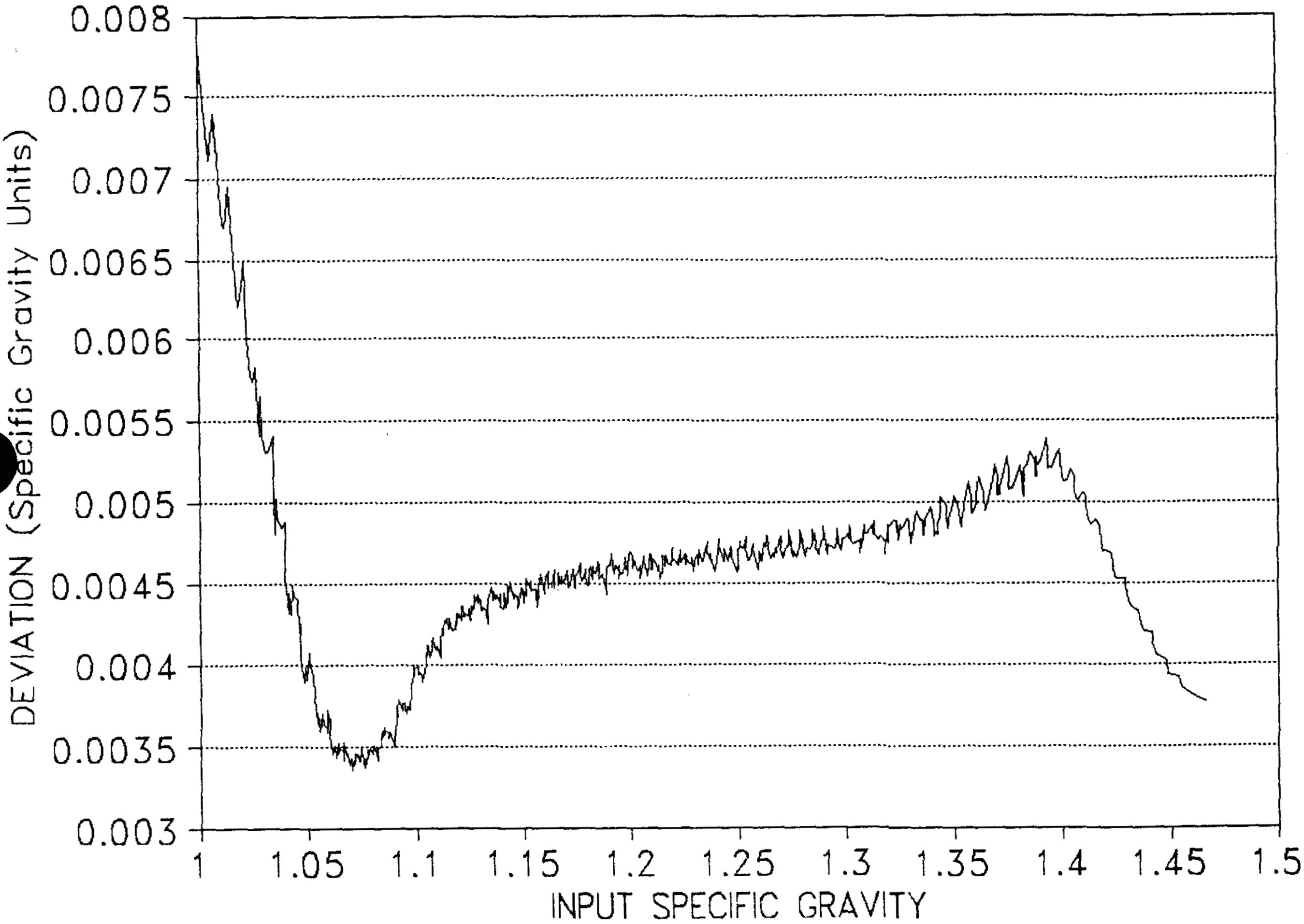
When a frequency distribution of the deviations were performed, it could be seen that 100% of the deviations fell within 0.012 SG units of the algebraic output slurry specific gravity. This is graphically shown in Fig. G-17. However, the average deviation is within 0.004 SG units of the algebraic output slurry specific gravity.

As was shown in the last section, the process control error is ± 0.01 SG units. This would make the net cumulative error in control of the output specific gravity to be ± 0.022 SG units if Equation 2 is used in its computation.

FIGURE G-16

DEVIATION BETWEEN ALGEBRAIC AND EQ. 2

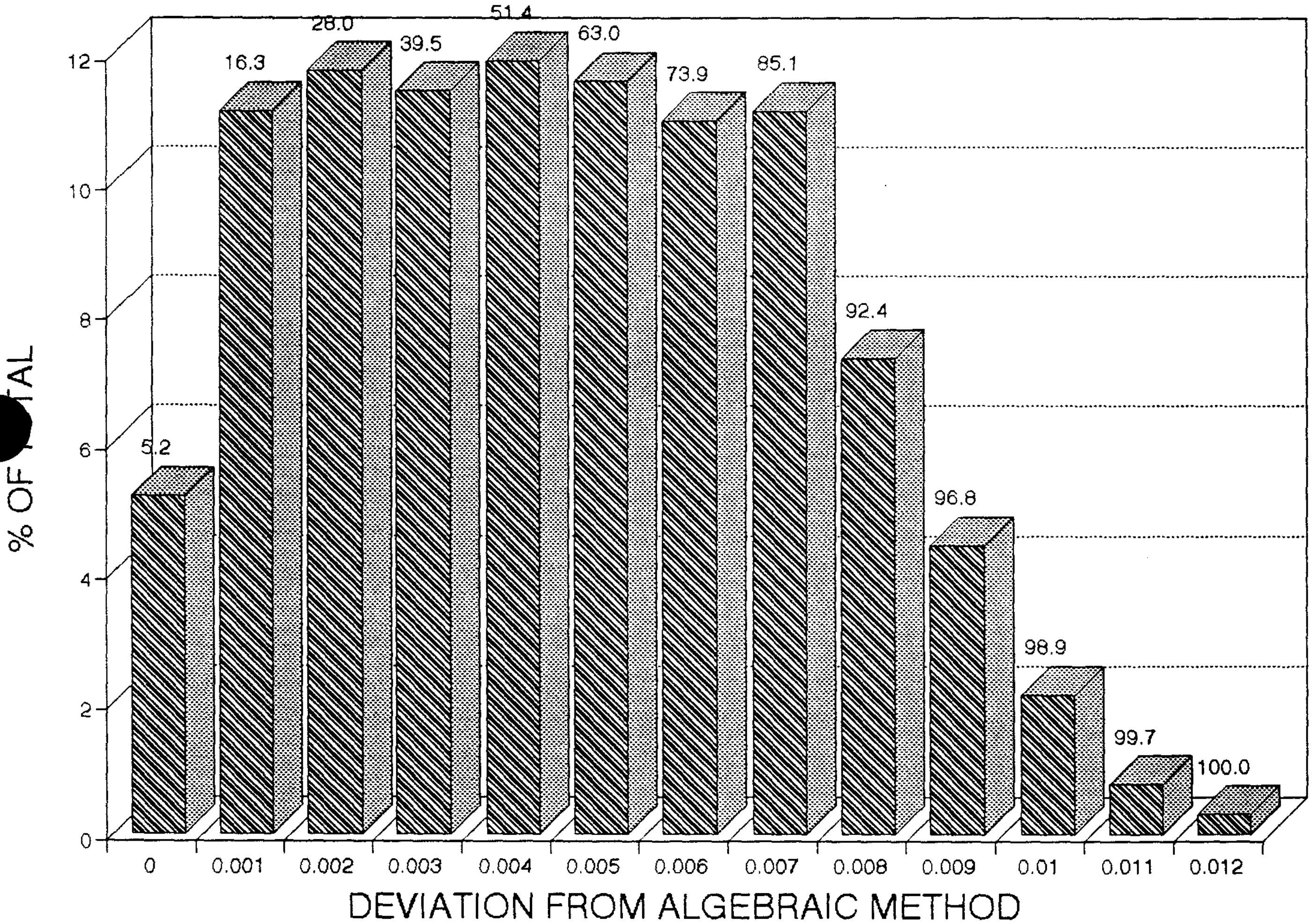
(Weighted Moving Average)



DEVA

FIGURE G-17

FREQUENCY DISTRIBUTION OF DEVIATIONS
IN SG OF EQUATION 2 FROM ALGEBRAIC



A.4301

TABLE G-13

DEVIATIONS BETWEEN ALGEBRAIC AND EQUATION 2

SPECIFIC GRAVITY OF POZZOLANS	2.900
SPECIFIC GRAVITY OF SALT	3.251
SPECIFIC GRAVITY OF SILT	2.23
W/P RATIO	0.42

TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	ALGEBRAIC OUTPUT SG	EQ 2 OUTPUT SG	DEVIATION
0	0	0.00	0	1.000	1.857	1.849	0.008
1	0	1.00	0	1.007	1.859	1.851	0.008
2	0	2.00	0	1.014	1.861	1.854	0.008
3	0	3.00	0	1.021	1.864	1.856	0.007
4	0	4.00	0	1.028	1.866	1.859	0.007
5	0	5.00	0	1.036	1.869	1.862	0.007
6	0	6.00	0	1.043	1.872	1.864	0.007
7	0	7.00	0	1.051	1.874	1.867	0.007
8	0	8.00	0	1.059	1.877	1.870	0.007
9	0	9.00	0	1.066	1.880	1.872	0.007
10	0	10.00	0	1.074	1.882	1.875	0.007
11	0	11.00	0	1.082	1.885	1.878	0.007
12	0	12.00	0	1.091	1.888	1.881	0.007
13	0	13.00	0	1.099	1.891	1.884	0.007
14	0	14.00	0	1.107	1.894	1.887	0.007
15	0	15.00	0	1.116	1.897	1.890	0.007
16	0	16.00	0	1.125	1.900	1.893	0.007
17	0	17.00	0	1.133	1.903	1.896	0.007
18	0	18.00	0	1.142	1.906	1.900	0.007
19	0	19.00	0	1.151	1.910	1.903	0.007
20	0	20.00	0	1.161	1.913	1.906	0.007
21	0	21.00	0	1.170	1.917	1.909	0.007
22	0	22.00	0	1.180	1.920	1.913	0.007
23	0	23.00	0	1.189	1.924	1.916	0.007
24	0	24.00	0	1.199	1.927	1.920	0.007
25	0	25.00	0	1.209	1.931	1.923	0.008
26	0	26.00	0	1.220	1.935	1.927	0.008
27	0	27.00	0	1.230	1.939	1.931	0.008
28	0	28.00	0	1.240	1.943	1.934	0.008
29	0	29.00	0	1.251	1.947	1.938	0.008
30	0	30.00	0	1.262	1.951	1.942	0.009
31	0	31.00	0	1.273	1.955	1.946	0.009
32	0	32.00	0	1.285	1.959	1.950	0.009
33	0	33.00	0	1.296	1.964	1.954	0.009
34	0	34.00	0	1.308	1.968	1.959	0.010

35	0	35.00	0	1.320	1.973	1.963	0.010
36	0	36.00	0	1.332	1.978	1.967	0.011
37	0	37.00	0	1.344	1.982	1.972	0.011
38	0	38.00	0	1.357	1.987	1.976	0.011
39	0	39.00	0	1.370	1.993	1.981	0.012
40	0	40.00	0	1.383	1.998	1.985	0.012
0	1	0.00	1	1.006	1.858	1.851	0.007
1	1	0.99	1	1.013	1.860	1.853	0.007
2	1	1.98	1	1.020	1.862	1.856	0.007
3	1	2.97	1	1.027	1.865	1.858	0.006
4	1	3.96	1	1.034	1.867	1.861	0.006
5	1	4.95	1	1.041	1.870	1.864	0.006
6	1	5.94	1	1.049	1.872	1.866	0.006
7	1	6.93	1	1.057	1.875	1.869	0.006
8	1	7.92	1	1.064	1.878	1.872	0.006
9	1	8.91	1	1.072	1.880	1.874	0.006
10	1	9.90	1	1.080	1.883	1.877	0.006
11	1	10.89	1	1.088	1.886	1.880	0.006
12	1	11.88	1	1.096	1.889	1.883	0.006
13	1	12.87	1	1.105	1.892	1.886	0.006
14	1	13.86	1	1.113	1.895	1.889	0.006
15	1	14.85	1	1.122	1.898	1.892	0.006
16	1	15.84	1	1.130	1.901	1.895	0.006
17	1	16.83	1	1.139	1.904	1.898	0.006
18	1	17.82	1	1.148	1.907	1.902	0.006
19	1	18.81	1	1.157	1.911	1.905	0.006
20	1	19.80	1	1.166	1.914	1.908	0.006
21	1	20.79	1	1.176	1.917	1.911	0.006
22	1	21.78	1	1.185	1.921	1.915	0.006
23	1	22.77	1	1.195	1.925	1.918	0.006
24	1	23.76	1	1.205	1.928	1.922	0.006
25	1	24.75	1	1.215	1.932	1.925	0.007
26	1	25.74	1	1.225	1.936	1.929	0.007
27	1	26.73	1	1.235	1.940	1.933	0.007
28	1	27.72	1	1.246	1.944	1.936	0.007
29	1	28.71	1	1.257	1.948	1.940	0.007
30	1	29.70	1	1.268	1.952	1.944	0.007
31	1	30.69	1	1.279	1.956	1.948	0.008
32	1	31.68	1	1.290	1.960	1.952	0.008
33	1	32.67	1	1.302	1.965	1.956	0.008
34	1	33.66	1	1.313	1.969	1.960	0.009
35	1	34.65	1	1.325	1.974	1.965	0.009
36	1	35.64	1	1.337	1.979	1.969	0.009
37	1	36.63	1	1.350	1.983	1.973	0.010
38	1	37.62	1	1.362	1.988	1.978	0.010

39	1	38.61	1	1.375	1.993	1.982	0.011
40	1	39.60	1	1.388	1.999	1.987	0.011
0	2	0.00	2	1.011	1.858	1.853	0.006
1	2	0.98	2	1.018	1.861	1.855	0.006
2	2	1.96	2	1.025	1.863	1.858	0.005
3	2	2.94	2	1.032	1.866	1.860	0.005
4	2	3.92	2	1.040	1.868	1.863	0.005
5	2	4.90	2	1.047	1.871	1.866	0.005
6	2	5.88	2	1.055	1.873	1.868	0.005
7	2	6.86	2	1.062	1.876	1.871	0.005
8	2	7.84	2	1.070	1.879	1.874	0.005
9	2	8.82	2	1.078	1.881	1.877	0.005
10	2	9.80	2	1.086	1.884	1.879	0.005
11	2	10.78	2	1.094	1.887	1.882	0.005
12	2	11.76	2	1.102	1.890	1.885	0.005
13	2	12.74	2	1.110	1.893	1.888	0.005
14	2	13.72	2	1.119	1.896	1.891	0.005
15	2	14.70	2	1.127	1.899	1.894	0.005
16	2	15.68	2	1.136	1.902	1.897	0.005
17	2	16.66	2	1.145	1.905	1.900	0.005
18	2	17.64	2	1.154	1.908	1.904	0.005
19	2	18.62	2	1.163	1.912	1.907	0.005
20	2	19.60	2	1.172	1.915	1.910	0.005
21	2	20.58	2	1.181	1.918	1.913	0.005
22	2	21.56	2	1.191	1.922	1.917	0.005
23	2	22.54	2	1.201	1.925	1.920	0.005
24	2	23.52	2	1.210	1.929	1.924	0.005
25	2	24.50	2	1.221	1.933	1.927	0.005
26	2	25.48	2	1.231	1.937	1.931	0.006
27	2	26.46	2	1.241	1.940	1.935	0.006
28	2	27.44	2	1.252	1.944	1.938	0.006
29	2	28.42	2	1.262	1.948	1.942	0.006
30	2	29.40	2	1.273	1.953	1.946	0.006
31	2	30.38	2	1.284	1.957	1.950	0.007
32	2	31.36	2	1.296	1.961	1.954	0.007
33	2	32.34	2	1.307	1.966	1.958	0.007
34	2	33.32	2	1.319	1.970	1.962	0.008
35	2	34.30	2	1.331	1.975	1.967	0.008
36	2	35.28	2	1.343	1.979	1.971	0.008
37	2	36.26	2	1.355	1.984	1.975	0.009
38	2	37.24	2	1.368	1.989	1.980	0.009
39	2	38.22	2	1.381	1.994	1.984	0.010
40	2	39.20	2	1.394	1.999	1.989	0.010
0	3	0.00	3	1.017	1.859	1.855	0.005
1	3	0.97	3	1.024	1.862	1.857	0.005

2	3	1.94	3	1.031	1.864	1.860	0.004
3	3	2.91	3	1.038	1.867	1.862	0.004
4	3	3.88	3	1.045	1.869	1.865	0.004
5	3	4.85	3	1.053	1.872	1.868	0.004
6	3	5.82	3	1.060	1.874	1.870	0.004
7	3	6.79	3	1.068	1.877	1.873	0.004
8	3	7.76	3	1.076	1.880	1.876	0.004
9	3	8.73	3	1.083	1.882	1.879	0.004
10	3	9.70	3	1.091	1.885	1.881	0.004
11	3	10.67	3	1.099	1.888	1.884	0.004
12	3	11.64	3	1.108	1.891	1.887	0.004
13	3	12.61	3	1.116	1.894	1.890	0.004
14	3	13.58	3	1.124	1.897	1.893	0.004
15	3	14.55	3	1.133	1.900	1.896	0.004
16	3	15.52	3	1.142	1.903	1.899	0.004
17	3	16.49	3	1.150	1.906	1.902	0.004
18	3	17.46	3	1.159	1.909	1.906	0.004
19	3	18.43	3	1.168	1.913	1.909	0.004
20	3	19.40	3	1.178	1.916	1.912	0.004
21	3	20.37	3	1.187	1.919	1.915	0.004
22	3	21.34	3	1.197	1.923	1.919	0.004
23	3	22.31	3	1.206	1.926	1.922	0.004
24	3	23.28	3	1.216	1.930	1.926	0.004
25	3	24.25	3	1.226	1.934	1.929	0.004
26	3	25.22	3	1.236	1.938	1.933	0.005
27	3	26.19	3	1.247	1.941	1.937	0.005
28	3	27.16	3	1.257	1.945	1.940	0.005
29	3	28.13	3	1.268	1.949	1.944	0.005
30	3	29.10	3	1.279	1.954	1.948	0.005
31	3	30.07	3	1.290	1.958	1.952	0.006
32	3	31.04	3	1.301	1.962	1.956	0.006
33	3	32.01	3	1.313	1.966	1.960	0.006
34	3	32.98	3	1.324	1.971	1.964	0.007
35	3	33.95	3	1.336	1.976	1.969	0.007
36	3	34.92	3	1.348	1.980	1.973	0.007
37	3	35.89	3	1.361	1.985	1.977	0.008
38	3	36.86	3	1.373	1.990	1.982	0.008
39	3	37.83	3	1.386	1.995	1.986	0.009
40	3	38.80	3	1.399	2.000	1.991	0.009
0	4	0.00	4	1.023	1.860	1.857	0.004
1	4	0.96	4	1.030	1.863	1.859	0.003
2	4	1.92	4	1.037	1.865	1.862	0.003
3	4	2.88	4	1.044	1.868	1.864	0.003
4	4	3.84	4	1.051	1.870	1.867	0.003
5	4	4.80	4	1.059	1.873	1.870	0.003

6	4	5.76	4	1.066	1.875	1.872	0.003
7	4	6.72	4	1.074	1.878	1.875	0.003
8	4	7.68	4	1.081	1.881	1.878	0.003
9	4	8.64	4	1.089	1.883	1.881	0.003
10	4	9.60	4	1.097	1.886	1.883	0.003
11	4	10.56	4	1.105	1.889	1.886	0.003
12	4	11.52	4	1.113	1.892	1.889	0.003
13	4	12.48	4	1.122	1.895	1.892	0.003
14	4	13.44	4	1.130	1.898	1.895	0.003
15	4	14.40	4	1.139	1.901	1.898	0.003
16	4	15.36	4	1.147	1.904	1.901	0.003
17	4	16.32	4	1.156	1.907	1.904	0.003
18	4	17.28	4	1.165	1.910	1.908	0.003
19	4	18.24	4	1.174	1.914	1.911	0.003
20	4	19.20	4	1.183	1.917	1.914	0.003
21	4	20.16	4	1.193	1.920	1.918	0.003
22	4	21.12	4	1.202	1.924	1.921	0.003
23	4	22.08	4	1.212	1.927	1.924	0.003
24	4	23.04	4	1.222	1.931	1.928	0.003
25	4	24.00	4	1.232	1.935	1.931	0.003
26	4	24.96	4	1.242	1.939	1.935	0.004
27	4	25.92	4	1.252	1.942	1.939	0.004
28	4	26.88	4	1.263	1.946	1.942	0.004
29	4	27.84	4	1.274	1.950	1.946	0.004
30	4	28.80	4	1.284	1.955	1.950	0.004
31	4	29.76	4	1.296	1.959	1.954	0.005
32	4	30.72	4	1.307	1.963	1.958	0.005
33	4	31.68	4	1.318	1.967	1.962	0.005
34	4	32.64	4	1.330	1.972	1.966	0.006
35	4	33.60	4	1.342	1.977	1.971	0.006
36	4	34.56	4	1.354	1.981	1.975	0.006
37	4	35.52	4	1.366	1.986	1.979	0.007
38	4	36.48	4	1.379	1.991	1.984	0.007
39	4	37.44	4	1.391	1.996	1.988	0.008
40	4	38.40	4	1.404	2.001	1.993	0.008
0	5	0.00	5	1.028	1.861	1.859	0.002
1	5	0.95	5	1.035	1.864	1.861	0.002
2	5	1.90	5	1.042	1.866	1.864	0.002
3	5	2.85	5	1.050	1.869	1.867	0.002
4	5	3.80	5	1.057	1.871	1.869	0.002
5	5	4.75	5	1.064	1.874	1.872	0.002
6	5	5.70	5	1.072	1.876	1.874	0.002
7	5	6.65	5	1.079	1.879	1.877	0.002
8	5	7.60	5	1.087	1.882	1.880	0.002
9	5	8.55	5	1.095	1.884	1.883	0.002

10	5	9.50	5	1.103	1.887	1.886	0.002
11	5	10.45	5	1.111	1.890	1.888	0.002
12	5	11.40	5	1.119	1.893	1.891	0.002
13	5	12.35	5	1.128	1.896	1.894	0.002
14	5	13.30	5	1.136	1.899	1.897	0.002
15	5	14.25	5	1.144	1.902	1.900	0.002
16	5	15.20	5	1.153	1.905	1.903	0.002
17	5	16.15	5	1.162	1.908	1.907	0.002
18	5	17.10	5	1.171	1.911	1.910	0.002
19	5	18.05	5	1.180	1.915	1.913	0.002
20	5	19.00	5	1.189	1.918	1.916	0.002
21	5	19.95	5	1.199	1.921	1.920	0.002
22	5	20.90	5	1.208	1.925	1.923	0.002
23	5	21.85	5	1.218	1.928	1.926	0.002
24	5	22.80	5	1.228	1.932	1.930	0.002
25	5	23.75	5	1.238	1.936	1.933	0.002
26	5	24.70	5	1.248	1.940	1.937	0.002
27	5	25.65	5	1.258	1.943	1.941	0.003
28	5	26.60	5	1.269	1.947	1.945	0.003
29	5	27.55	5	1.279	1.951	1.948	0.003
30	5	28.50	5	1.290	1.955	1.952	0.003
31	5	29.45	5	1.301	1.960	1.956	0.004
32	5	30.40	5	1.312	1.964	1.960	0.004
33	5	31.35	5	1.324	1.968	1.964	0.004
34	5	32.30	5	1.336	1.973	1.968	0.005
35	5	33.25	5	1.347	1.977	1.973	0.005
36	5	34.20	5	1.359	1.982	1.977	0.005
37	5	35.15	5	1.372	1.987	1.981	0.006
38	5	36.10	5	1.384	1.992	1.986	0.006
39	5	37.05	5	1.397	1.997	1.990	0.007
40	5	38.00	5	1.410	2.002	1.995	0.007
0	6	0.00	6	1.034	1.862	1.861	0.001
1	6	0.94	6	1.041	1.865	1.864	0.001
2	6	1.88	6	1.048	1.867	1.866	0.001
3	6	2.82	6	1.056	1.870	1.869	0.001
4	6	3.76	6	1.063	1.872	1.871	0.001
5	6	4.70	6	1.070	1.875	1.874	0.001
6	6	5.64	6	1.078	1.877	1.877	0.001
7	6	6.58	6	1.085	1.880	1.879	0.001
8	6	7.52	6	1.093	1.883	1.882	0.001
9	6	8.46	6	1.101	1.885	1.885	0.001
10	6	9.40	6	1.109	1.888	1.888	0.001
11	6	10.34	6	1.117	1.891	1.890	0.001
12	6	11.28	6	1.125	1.894	1.893	0.001
13	6	12.22	6	1.133	1.897	1.896	0.000

14	6	13.16	6	1.142	1.900	1.899	0.000
15	6	14.10	6	1.150	1.903	1.902	0.000
16	6	15.04	6	1.159	1.906	1.905	0.000
17	6	15.98	6	1.168	1.909	1.909	0.001
18	6	16.92	6	1.177	1.912	1.912	0.001
19	6	17.86	6	1.186	1.916	1.915	0.001
20	6	18.80	6	1.195	1.919	1.918	0.001
21	6	19.74	6	1.204	1.922	1.922	0.001
22	6	20.68	6	1.214	1.926	1.925	0.001
23	6	21.62	6	1.224	1.929	1.929	0.001
24	6	22.56	6	1.234	1.933	1.932	0.001
25	6	23.50	6	1.243	1.937	1.936	0.001
26	6	24.44	6	1.254	1.941	1.939	0.001
27	6	25.38	6	1.264	1.944	1.943	0.002
28	6	26.32	6	1.274	1.948	1.947	0.002
29	6	27.26	6	1.285	1.952	1.950	0.002
30	6	28.20	6	1.296	1.956	1.954	0.002
31	6	29.14	6	1.307	1.961	1.958	0.003
32	6	30.08	6	1.318	1.965	1.962	0.003
33	6	31.02	6	1.330	1.969	1.966	0.003
34	6	31.96	6	1.341	1.974	1.970	0.004
35	6	32.90	6	1.353	1.978	1.975	0.004
36	6	33.84	6	1.365	1.983	1.979	0.004
37	6	34.78	6	1.377	1.988	1.983	0.005
38	6	35.72	6	1.390	1.993	1.988	0.005
39	6	36.66	6	1.402	1.998	1.992	0.006
40	6	37.60	6	1.415	2.003	1.997	0.006
0	7	0.00	7	1.040	1.863	1.863	0.000
1	7	0.93	7	1.047	1.866	1.866	0.000
2	7	1.86	7	1.054	1.868	1.868	0.000
3	7	2.79	7	1.061	1.871	1.871	0.000
4	7	3.72	7	1.069	1.873	1.873	0.000
5	7	4.65	7	1.076	1.876	1.876	0.000
6	7	5.58	7	1.084	1.878	1.879	0.000
7	7	6.51	7	1.091	1.881	1.881	0.000
8	7	7.44	7	1.099	1.884	1.884	0.000
9	7	8.37	7	1.107	1.886	1.887	0.000
10	7	9.30	7	1.115	1.889	1.890	0.001
11	7	10.23	7	1.123	1.892	1.893	0.001
12	7	11.16	7	1.131	1.895	1.896	0.001
13	7	12.09	7	1.139	1.898	1.898	0.001
14	7	13.02	7	1.148	1.901	1.901	0.001
15	7	13.95	7	1.156	1.904	1.905	0.001
16	7	14.88	7	1.165	1.907	1.908	0.001
17	7	15.81	7	1.174	1.910	1.911	0.001

18	7	16.74	7	1.183	1.913	1.914	0.001
19	7	17.67	7	1.192	1.917	1.917	0.000
20	7	18.60	7	1.201	1.920	1.920	0.000
21	7	19.53	7	1.210	1.923	1.924	0.000
22	7	20.46	7	1.220	1.927	1.927	0.000
23	7	21.39	7	1.230	1.930	1.931	0.000
24	7	22.32	7	1.239	1.934	1.934	0.000
25	7	23.25	7	1.249	1.938	1.938	0.000
26	7	24.18	7	1.259	1.942	1.941	0.000
27	7	25.11	7	1.270	1.945	1.945	0.000
28	7	26.04	7	1.280	1.949	1.949	0.001
29	7	26.97	7	1.291	1.953	1.952	0.001
30	7	27.90	7	1.302	1.957	1.956	0.001
31	7	28.83	7	1.313	1.962	1.960	0.001
32	7	29.76	7	1.324	1.966	1.964	0.002
33	7	30.69	7	1.335	1.970	1.968	0.002
34	7	31.62	7	1.347	1.975	1.972	0.002
35	7	32.55	7	1.359	1.979	1.977	0.003
36	7	33.48	7	1.371	1.984	1.981	0.003
37	7	34.41	7	1.383	1.989	1.985	0.004
38	7	35.34	7	1.395	1.994	1.990	0.004
39	7	36.27	7	1.408	1.999	1.994	0.005
40	7	37.20	7	1.421	2.004	1.999	0.005
0	8	0.00	8	1.046	1.864	1.865	0.001
1	8	0.92	8	1.053	1.867	1.868	0.001
2	8	1.84	8	1.060	1.869	1.870	0.001
3	8	2.76	8	1.068	1.872	1.873	0.001
4	8	3.68	8	1.075	1.874	1.875	0.001
5	8	4.60	8	1.082	1.877	1.878	0.001
6	8	5.52	8	1.090	1.879	1.881	0.001
7	8	6.44	8	1.097	1.882	1.884	0.001
8	8	7.36	8	1.105	1.885	1.886	0.002
9	8	8.28	8	1.113	1.887	1.889	0.002
10	8	9.20	8	1.121	1.890	1.892	0.002
11	8	10.12	8	1.129	1.893	1.895	0.002
12	8	11.04	8	1.137	1.896	1.898	0.002
13	8	11.96	8	1.145	1.899	1.901	0.002
14	8	12.88	8	1.154	1.902	1.904	0.002
15	8	13.80	8	1.162	1.905	1.907	0.002
16	8	14.72	8	1.171	1.908	1.910	0.002
17	8	15.64	8	1.180	1.911	1.913	0.002
18	8	16.56	8	1.189	1.914	1.916	0.002
19	8	17.48	8	1.198	1.918	1.919	0.002
20	8	18.40	8	1.207	1.921	1.923	0.002
21	8	19.32	8	1.216	1.924	1.926	0.001

22	8	20.24	8	1.226	1.928	1.929	0.001
23	8	21.16	8	1.236	1.932	1.933	0.001
24	8	22.08	8	1.245	1.935	1.936	0.001
25	8	23.00	8	1.255	1.939	1.940	0.001
26	8	23.92	8	1.265	1.943	1.943	0.001
27	8	24.84	8	1.276	1.946	1.947	0.001
28	8	25.76	8	1.286	1.950	1.951	0.000
29	8	26.68	8	1.297	1.954	1.955	0.000
30	8	27.60	8	1.308	1.958	1.958	0.000
31	8	28.52	8	1.319	1.963	1.962	0.000
32	8	29.44	8	1.330	1.967	1.966	0.001
33	8	30.36	8	1.341	1.971	1.970	0.001
34	8	31.28	8	1.353	1.976	1.974	0.001
35	8	32.20	8	1.364	1.980	1.979	0.002
36	8	33.12	8	1.376	1.985	1.983	0.002
37	8	34.04	8	1.389	1.990	1.987	0.003
38	8	34.96	8	1.401	1.995	1.992	0.003
39	8	35.88	8	1.414	2.000	1.996	0.004
40	8	36.80	8	1.426	2.005	2.001	0.004
0	9	0.00	9	1.052	1.866	1.867	0.002
1	9	0.91	9	1.059	1.868	1.870	0.002
2	9	1.82	9	1.066	1.870	1.872	0.002
3	9	2.73	9	1.074	1.873	1.875	0.002
4	9	3.64	9	1.081	1.875	1.878	0.002
5	9	4.55	9	1.088	1.878	1.880	0.002
6	9	5.46	9	1.096	1.880	1.883	0.002
7	9	6.37	9	1.103	1.883	1.886	0.003
8	9	7.28	9	1.111	1.886	1.888	0.003
9	9	8.19	9	1.119	1.889	1.891	0.003
10	9	9.10	9	1.127	1.891	1.894	0.003
11	9	10.01	9	1.135	1.894	1.897	0.003
12	9	10.92	9	1.143	1.897	1.900	0.003
13	9	11.83	9	1.151	1.900	1.903	0.003
14	9	12.74	9	1.160	1.903	1.906	0.003
15	9	13.65	9	1.168	1.906	1.909	0.003
16	9	14.56	9	1.177	1.909	1.912	0.003
17	9	15.47	9	1.186	1.912	1.915	0.003
18	9	16.38	9	1.195	1.915	1.918	0.003
19	9	17.29	9	1.204	1.919	1.921	0.003
20	9	18.20	9	1.213	1.922	1.925	0.003
21	9	19.11	9	1.222	1.926	1.928	0.003
22	9	20.02	9	1.232	1.929	1.931	0.002
23	9	20.93	9	1.242	1.933	1.935	0.002
24	9	21.84	9	1.251	1.936	1.938	0.002
25	9	22.75	9	1.261	1.940	1.942	0.002

26	9	23.66	9	1.271	1.944	1.946	0.002
27	9	24.57	9	1.282	1.947	1.949	0.002
28	9	25.48	9	1.292	1.951	1.953	0.001
29	9	26.39	9	1.303	1.955	1.957	0.001
30	9	27.30	9	1.313	1.960	1.960	0.001
31	9	28.21	9	1.324	1.964	1.964	0.001
32	9	29.12	9	1.336	1.968	1.968	0.000
33	9	30.03	9	1.347	1.972	1.972	0.000
34	9	30.94	9	1.358	1.977	1.977	0.000
35	9	31.85	9	1.370	1.981	1.981	0.001
36	9	32.76	9	1.382	1.986	1.985	0.001
37	9	33.67	9	1.394	1.991	1.989	0.002
38	9	34.58	9	1.407	1.996	1.994	0.002
39	9	35.49	9	1.419	2.001	1.998	0.003
40	9	36.40	9	1.432	2.006	2.003	0.003
0	10	0.00	10	1.058	1.867	1.870	0.003
1	10	0.90	10	1.065	1.869	1.872	0.003
2	10	1.80	10	1.073	1.871	1.875	0.003
3	10	2.70	10	1.080	1.874	1.877	0.003
4	10	3.60	10	1.087	1.876	1.880	0.003
5	10	4.50	10	1.094	1.879	1.882	0.004
6	10	5.40	10	1.102	1.882	1.885	0.004
7	10	6.30	10	1.110	1.884	1.888	0.004
8	10	7.20	10	1.117	1.887	1.891	0.004
9	10	8.10	10	1.125	1.890	1.893	0.004
10	10	9.00	10	1.133	1.892	1.896	0.004
11	10	9.90	10	1.141	1.895	1.899	0.004
12	10	10.80	10	1.149	1.898	1.902	0.004
13	10	11.70	10	1.158	1.901	1.905	0.004
14	10	12.60	10	1.166	1.904	1.908	0.004
15	10	13.50	10	1.175	1.907	1.911	0.004
16	10	14.40	10	1.183	1.910	1.914	0.004
17	10	15.30	10	1.192	1.913	1.917	0.004
18	10	16.20	10	1.201	1.917	1.920	0.004
19	10	17.10	10	1.210	1.920	1.924	0.004
20	10	18.00	10	1.219	1.923	1.927	0.004
21	10	18.90	10	1.229	1.927	1.930	0.004
22	10	19.80	10	1.238	1.930	1.934	0.004
23	10	20.70	10	1.248	1.934	1.937	0.003
24	10	21.60	10	1.257	1.937	1.941	0.003
25	10	22.50	10	1.267	1.941	1.944	0.003
26	10	23.40	10	1.277	1.945	1.948	0.003
27	10	24.30	10	1.288	1.949	1.951	0.003
28	10	25.20	10	1.298	1.952	1.955	0.003
29	10	26.10	10	1.309	1.956	1.959	0.002

30	10	27.00	10	1.319	1.961	1.963	0.002
31	10	27.90	10	1.330	1.965	1.967	0.002
32	10	28.80	10	1.342	1.969	1.970	0.001
33	10	29.70	10	1.353	1.973	1.975	0.001
34	10	30.60	10	1.364	1.978	1.979	0.001
35	10	31.50	10	1.376	1.982	1.983	0.000
36	10	32.40	10	1.388	1.987	1.987	0.000
37	10	33.30	10	1.400	1.992	1.991	0.001
38	10	34.20	10	1.412	1.997	1.996	0.001
39	10	35.10	10	1.425	2.002	2.000	0.002
40	10	36.00	10	1.438	2.007	2.005	0.002
0	11	0.00	11	1.065	1.868	1.872	0.004
1	11	0.89	11	1.072	1.870	1.874	0.004
2	11	1.78	11	1.079	1.872	1.877	0.004
3	11	2.67	11	1.086	1.875	1.879	0.004
4	11	3.56	11	1.093	1.877	1.882	0.005
5	11	4.45	11	1.101	1.880	1.885	0.005
6	11	5.34	11	1.108	1.883	1.887	0.005
7	11	6.23	11	1.116	1.885	1.890	0.005
8	11	7.12	11	1.124	1.888	1.893	0.005
9	11	8.01	11	1.131	1.891	1.896	0.005
10	11	8.90	11	1.139	1.893	1.898	0.005
11	11	9.79	11	1.147	1.896	1.901	0.005
12	11	10.68	11	1.156	1.899	1.904	0.005
13	11	11.57	11	1.164	1.902	1.907	0.005
14	11	12.46	11	1.172	1.905	1.910	0.005
15	11	13.35	11	1.181	1.908	1.913	0.005
16	11	14.24	11	1.189	1.911	1.916	0.005
17	11	15.13	11	1.198	1.914	1.919	0.005
18	11	16.02	11	1.207	1.918	1.923	0.005
19	11	16.91	11	1.216	1.921	1.926	0.005
20	11	17.80	11	1.225	1.924	1.929	0.005
21	11	18.69	11	1.235	1.928	1.932	0.005
22	11	19.58	11	1.244	1.931	1.936	0.005
23	11	20.47	11	1.254	1.935	1.939	0.005
24	11	21.36	11	1.264	1.938	1.943	0.004
25	11	22.25	11	1.273	1.942	1.946	0.004
26	11	23.14	11	1.284	1.946	1.950	0.004
27	11	24.03	11	1.294	1.950	1.953	0.004
28	11	24.92	11	1.304	1.954	1.957	0.004
29	11	25.81	11	1.315	1.958	1.961	0.003
30	11	26.70	11	1.325	1.962	1.965	0.003
31	11	27.59	11	1.336	1.966	1.969	0.003
32	11	28.48	11	1.347	1.970	1.973	0.003
33	11	29.37	11	1.359	1.974	1.977	0.002

34	11	30.26	11	1.370	1.979	1.981	0.002
35	11	31.15	11	1.382	1.983	1.985	0.001
36	11	32.04	11	1.394	1.988	1.989	0.001
37	11	32.93	11	1.406	1.993	1.993	0.001
38	11	33.82	11	1.418	1.998	1.998	0.000
39	11	34.71	11	1.431	2.003	2.002	0.001
40	11	35.60	11	1.443	2.008	2.007	0.001
0	12	0.00	12	1.071	1.869	1.874	0.005
1	12	0.88	12	1.078	1.871	1.877	0.005
2	12	1.76	12	1.085	1.874	1.879	0.006
3	12	2.64	12	1.092	1.876	1.882	0.006
4	12	3.52	12	1.100	1.879	1.884	0.006
5	12	4.40	12	1.107	1.881	1.887	0.006
6	12	5.28	12	1.115	1.884	1.890	0.006
7	12	6.16	12	1.122	1.886	1.892	0.006
8	12	7.04	12	1.130	1.889	1.895	0.006
9	12	7.92	12	1.138	1.892	1.898	0.006
10	12	8.80	12	1.146	1.895	1.901	0.006
11	12	9.68	12	1.154	1.897	1.904	0.006
12	12	10.56	12	1.162	1.900	1.906	0.006
13	12	11.44	12	1.170	1.903	1.909	0.006
14	12	12.32	12	1.179	1.906	1.912	0.006
15	12	13.20	12	1.187	1.909	1.915	0.006
16	12	14.08	12	1.196	1.912	1.919	0.006
17	12	14.96	12	1.204	1.916	1.922	0.006
18	12	15.84	12	1.213	1.919	1.925	0.006
19	12	16.72	12	1.222	1.922	1.928	0.006
20	12	17.60	12	1.232	1.925	1.931	0.006
21	12	18.48	12	1.241	1.929	1.935	0.006
22	12	19.36	12	1.250	1.932	1.938	0.006
23	12	20.24	12	1.260	1.936	1.941	0.006
24	12	21.12	12	1.270	1.939	1.945	0.005
25	12	22.00	12	1.280	1.943	1.948	0.005
26	12	22.88	12	1.290	1.947	1.952	0.005
27	12	23.76	12	1.300	1.951	1.956	0.005
28	12	24.64	12	1.310	1.955	1.959	0.005
29	12	25.52	12	1.321	1.959	1.963	0.004
30	12	26.40	12	1.332	1.963	1.967	0.004
31	12	27.28	12	1.342	1.967	1.971	0.004
32	12	28.16	12	1.353	1.971	1.975	0.004
33	12	29.04	12	1.365	1.976	1.979	0.003
34	12	29.92	12	1.376	1.980	1.983	0.003
35	12	30.80	12	1.388	1.985	1.987	0.002
36	12	31.68	12	1.400	1.989	1.991	0.002
37	12	32.56	12	1.412	1.994	1.995	0.002

38	12	33.44	12	1.424	1.999	2.000	0.001
39	12	34.32	12	1.436	2.004	2.004	0.001
40	12	35.20	12	1.449	2.009	2.009	0.000
0	13	0.00	13	1.077	1.870	1.876	0.006
1	13	0.87	13	1.084	1.872	1.879	0.007
2	13	1.74	13	1.091	1.875	1.881	0.007
3	13	2.61	13	1.099	1.877	1.884	0.007
4	13	3.48	13	1.106	1.880	1.887	0.007
5	13	4.35	13	1.113	1.882	1.889	0.007
6	13	5.22	13	1.121	1.885	1.892	0.007
7	13	6.09	13	1.129	1.888	1.895	0.007
8	13	6.96	13	1.136	1.890	1.897	0.007
9	13	7.83	13	1.144	1.893	1.900	0.007
10	13	8.70	13	1.152	1.896	1.903	0.007
11	13	9.57	13	1.160	1.899	1.906	0.007
12	13	10.44	13	1.168	1.901	1.909	0.007
13	13	11.31	13	1.176	1.904	1.912	0.007
14	13	12.18	13	1.185	1.907	1.915	0.007
15	13	13.05	13	1.193	1.910	1.918	0.007
16	13	13.92	13	1.202	1.914	1.921	0.007
17	13	14.79	13	1.211	1.917	1.924	0.007
18	13	15.66	13	1.220	1.920	1.927	0.007
19	13	16.53	13	1.229	1.923	1.930	0.007
20	13	17.40	13	1.238	1.927	1.934	0.007
21	13	18.27	13	1.247	1.930	1.937	0.007
22	13	19.14	13	1.257	1.933	1.940	0.007
23	13	20.01	13	1.266	1.937	1.944	0.007
24	13	20.88	13	1.276	1.941	1.947	0.007
25	13	21.75	13	1.286	1.944	1.951	0.006
26	13	22.62	13	1.296	1.948	1.954	0.006
27	13	23.49	13	1.306	1.952	1.958	0.006
28	13	24.36	13	1.316	1.956	1.962	0.006
29	13	25.23	13	1.327	1.960	1.965	0.006
30	13	26.10	13	1.338	1.964	1.969	0.005
31	13	26.97	13	1.349	1.968	1.973	0.005
32	13	27.84	13	1.360	1.972	1.977	0.005
33	13	28.71	13	1.371	1.977	1.981	0.004
34	13	29.58	13	1.382	1.981	1.985	0.004
35	13	30.45	13	1.394	1.986	1.989	0.004
36	13	31.32	13	1.406	1.990	1.993	0.003
37	13	32.19	13	1.418	1.995	1.998	0.003
38	13	33.06	13	1.430	2.000	2.002	0.002
39	13	33.93	13	1.442	2.005	2.006	0.002
40	13	34.80	13	1.455	2.010	2.011	0.001
0	14	0.00	14	1.084	1.871	1.879	0.008

1	14	0.86	14	1.091	1.873	1.881	0.008
2	14	1.72	14	1.098	1.876	1.884	0.008
3	14	2.58	14	1.105	1.878	1.886	0.008
4	14	3.44	14	1.112	1.881	1.889	0.008
5	14	4.30	14	1.120	1.883	1.892	0.008
6	14	5.16	14	1.127	1.886	1.894	0.008
7	14	6.02	14	1.135	1.889	1.897	0.008
8	14	6.88	14	1.143	1.891	1.900	0.008
9	14	7.74	14	1.150	1.894	1.902	0.008
10	14	8.60	14	1.158	1.897	1.905	0.008
11	14	9.46	14	1.166	1.900	1.908	0.008
12	14	10.32	14	1.175	1.903	1.911	0.008
13	14	11.18	14	1.183	1.906	1.914	0.008
14	14	12.04	14	1.191	1.909	1.917	0.008
15	14	12.90	14	1.200	1.912	1.920	0.008
16	14	13.76	14	1.208	1.915	1.923	0.008
17	14	14.62	14	1.217	1.918	1.926	0.008
18	14	15.48	14	1.226	1.921	1.929	0.008
19	14	16.34	14	1.235	1.924	1.933	0.008
20	14	17.20	14	1.244	1.928	1.936	0.008
21	14	18.06	14	1.254	1.931	1.939	0.008
22	14	18.92	14	1.263	1.935	1.943	0.008
23	14	19.78	14	1.273	1.938	1.946	0.008
24	14	20.64	14	1.282	1.942	1.949	0.008
25	14	21.50	14	1.292	1.945	1.953	0.008
26	14	22.36	14	1.302	1.949	1.956	0.007
27	14	23.22	14	1.312	1.953	1.960	0.007
28	14	24.08	14	1.323	1.957	1.964	0.007
29	14	24.94	14	1.333	1.961	1.968	0.007
30	14	25.80	14	1.344	1.965	1.971	0.006
31	14	26.66	14	1.355	1.969	1.975	0.006
32	14	27.52	14	1.366	1.973	1.979	0.006
33	14	28.38	14	1.377	1.978	1.983	0.005
34	14	29.24	14	1.388	1.982	1.987	0.005
35	14	30.10	14	1.400	1.987	1.991	0.005
36	14	30.96	14	1.412	1.991	1.995	0.004
37	14	31.82	14	1.424	1.996	2.000	0.004
38	14	32.68	14	1.436	2.001	2.004	0.003
39	14	33.54	14	1.448	2.006	2.008	0.003
40	14	34.40	14	1.461	2.011	2.013	0.002
0	15	0.00	15	1.090	1.872	1.881	0.009
1	15	0.85	15	1.097	1.875	1.883	0.009
2	15	1.70	15	1.104	1.877	1.886	0.009
3	15	2.55	15	1.112	1.879	1.889	0.009
4	15	3.40	15	1.119	1.882	1.891	0.009

5	15	4.25	15	1.126	1.885	1.894	0.009
6	15	5.10	15	1.134	1.887	1.897	0.009
7	15	5.95	15	1.141	1.890	1.899	0.009
8	15	6.80	15	1.149	1.893	1.902	0.009
9	15	7.65	15	1.157	1.895	1.905	0.009
10	15	8.50	15	1.165	1.898	1.908	0.010
11	15	9.35	15	1.173	1.901	1.910	0.010
12	15	10.20	15	1.181	1.904	1.913	0.010
13	15	11.05	15	1.189	1.907	1.916	0.010
14	15	11.90	15	1.198	1.910	1.919	0.010
15	15	12.75	15	1.206	1.913	1.922	0.010
16	15	13.60	15	1.215	1.916	1.925	0.010
17	15	14.45	15	1.224	1.919	1.929	0.010
18	15	15.30	15	1.233	1.922	1.932	0.009
19	15	16.15	15	1.242	1.925	1.935	0.009
20	15	17.00	15	1.251	1.929	1.938	0.009
21	15	17.85	15	1.260	1.932	1.941	0.009
22	15	18.70	15	1.269	1.936	1.945	0.009
23	15	19.55	15	1.279	1.939	1.948	0.009
24	15	20.40	15	1.289	1.943	1.952	0.009
25	15	21.25	15	1.298	1.947	1.955	0.009
26	15	22.10	15	1.308	1.950	1.959	0.008
27	15	22.95	15	1.319	1.954	1.962	0.008
28	15	23.80	15	1.329	1.958	1.966	0.008
29	15	24.65	15	1.339	1.962	1.970	0.008
30	15	25.50	15	1.350	1.966	1.974	0.007
31	15	26.35	15	1.361	1.970	1.977	0.007
32	15	27.20	15	1.372	1.974	1.981	0.007
33	15	28.05	15	1.383	1.979	1.985	0.007
34	15	28.90	15	1.394	1.983	1.989	0.006
35	15	29.75	15	1.406	1.988	1.993	0.006
36	15	30.60	15	1.418	1.992	1.998	0.005
37	15	31.45	15	1.430	1.997	2.002	0.005
38	15	32.30	15	1.442	2.002	2.006	0.004
39	15	33.15	15	1.454	2.007	2.011	0.004
40	15	34.00	15	1.467	2.012	2.015	0.003

AVERAGE DEVIATION	0.004
MAXIMUM DEVIATION	0.012

V DERIVATION OF EQUATION 3

Purpose

The purpose behind Equation 3 was to have one equation for Pond 207C waste processing, which could be used to calculate the output slurry specific gravity if the specific gravity of the pozzolans, the input slurry specific gravity, and the percentage of Clarifier TSS as a percentage of total TSS are known.

Derivation

The output slurry specific gravity and the input slurry specific gravity can be algebraically calculated as shown in Section I. This was performed for different scenarios of input slurry TDS and TSS.

For a given value of the percentage of Clarifier TSS that forms part of the of total TSS (hereafter referred to as D) and a given pozzolan specific gravity, the input slurry specific gravity and the output slurry specific gravity were calculated. The TDS was varied from 0 to 40% (in increments of 1%) and the TSS was varied from 0 to 15% (in increments of 2.5%). This produced 147 different cases for which the input slurry specific gravity and the output slurry specific gravity were calculated.

A linear regression was performed on the resulting output slurry specific gravity versus the input slurry specific gravity. For each D value, this procedure was repeated for pozzolan specific gravities ranging from 2.6 to 3.4 in increments of 0.1.

Using the following symbols for the variables,

B = Specific Gravity of Pozzolans,
C = Specific Gravity of Input Slurry and
D = Clarifier TSS as a percentage of total TSS,

When Output Slurry Specific Gravity is plotted against Input Slurry Specific Gravity the data can be linearized to yield:

$$SG_{out}=mC+c \tag{3a}$$

where ***m*** is the slope of the line and ***c*** is the y-intercept for the data set.

The linearization of the output slurry specific gravity versus the input slurry specific gravity was repeated for Pozzolan Specific Gravities (B) from 2.6 to 3.4 in increments of 0.1. The x-coefficients and y-intercepts of equation 1a, when plotted against the pozzolan specific gravity gave good straight line fits having x-coefficients and y-intercepts.

For ***m*** v^s ***B***,

$$m = m'mB + m'c \tag{3b}$$

where ***m'm*** and ***m'c*** are the slope and intercept of the line, respectively.

For ***c*** vs ***B***,

$$c = c'mB + c'c \tag{3c}$$

where ***c'm*** and ***c'c*** are the slope and intercept of the line respectively.

When 1b and 1c are incorporated into Equation 1a,

$$SG_{out} = (m'mB + m'c)C + c'mB + c'c \tag{3d}$$

The entire procedure was repeated for D values ranging from 0% to 100% in increments of 10%.

The results are shown in Tables G-14 to G-24.

When ***m'm***, ***m'c***, ***c'm***, and ***c'c*** are plotted against the W/P ratios, the data can be represented best in the form of four linear equations:

$$m'm = 5.9422E{-}5D - 0.0388898 \tag{3e}$$

$$m'c = -6E{-}5D + 0.46859 \tag{3f}$$

$$c'm = -4.484E{-}5D + 0.31666994 \tag{3g}$$

$$c'c = 4.55E{-}5D + 0.571779 \tag{3h}$$

These are shown in Table G-25.

Substituting 3e, 3f, 3g, and 3h in 3d,

$$\boxed{\begin{aligned} SG_{out} = {} & 5.9422E{-}5BCD - 0.0388898BC - 6E{-}5CD + 0.46859C \\ & -4.484E{-}5BD + 0.31666994B + 4.55E{-}5D + 0.571779 \end{aligned}} \tag{3}$$

This equation allows the calculation of the output slurry specific gravity if the input slurry specific gravity, pozzolan specific gravity and the value of Clarifer TSS which is part of the total TSS are known for Pond 207C/Clarifer waste processing.

TABLE G-25

D(%)	m'm	m'c	c'm	c'c
0	-0.0387863	0.46846476	0.31653964	0.571931
10	-0.0382549	0.46793588	0.31617016	0.572294
20	-0.0377091	0.46738985	0.31578262	0.572678
30	-0.037149	0.46682681	0.31537721	0.573082
40	-0.0365748	0.4662469	0.31495417	0.573507
50	-0.0359868	0.46565026	0.3145137	0.573952
60	-0.0353852	0.46503703	0.31405602	0.574418
70	-0.0347701	0.46440737	0.31358137	0.574903
80	-0.0341419	0.46376141	0.31308997	0.575408
90	-0.0335007	0.46309932	0.31258205	0.575932
100	-0.0328467	0.46242126	0.31205785	0.576477

m'm Regression Output:			m'c Regression Output:		
Constant		-0.0388898	Constant		0.46859
Std Err of Y Est		6.652E-05	Std Err of Y Est		8.09E-05
R Squared		0.99897573	R Squared		0.998535
No. of Observations		11	No. of Observations		11
Degrees of Freedom		9	Degrees of Freedom		9
X Coefficient(s)	5.9422E-05		X Coefficient(s)	-6E-05	
Std Err of Coef.	6.3424E-07		Std Err of Coef.	7.72E-07	

c'm Regression Output:			c'c Regression Output:		
Constant		0.31666994	Constant		0.571779
Std Err of Y Est		8.3956E-05	Std Err of Y Est		9.82E-05
R Squared		0.99714052	R Squared		0.996201
No. of Observations		11	No. of Observations		11
Degrees of Freedom		9	Degrees of Freedom		9
X Coefficient(s)	-4.484E-05		X Coefficient(s)	4.55E-05	
Std Err of Coef.	8.0049E-07		Std Err of Coef.	9.36E-07	

VII ERROR IN EQUATION 3

To estimate the error of the math in Equation 3, the equation was tested for the entire range of input slurry specific gravity scenarios arising from different TDS and TSS combinations. The comparison was performed between the algebraic output slurry specific gravity and the output slurry specific gravity calculated by Equation 1 for each of these situations. The TDS was varied from 0 to 40% in increments of 1% and the TSS was varied from 0 to 15% in increments of 1%. This produced 656 different input waste scenarios.

The difference between the algebraic output slurry specific gravity and the Equation 1 output slurry specific gravity was calculated for each of the 656 situations. The results are shown in Table G-26. Fig. G-18 shows the weighted moving average of the output slurry specific gravities as a function of input slurry specific gravity.

When a frequency distribution of the deviations were performed, it could be seen that 100% of the deviations fell within 0.012 SG units of the algebraic output slurry specific gravity. However, the average deviation is within 0.004 SG units of the algebraic output slurry specific gravity.

As was shown in Section IV, the process control error of the Halliburton RCM is ± 0.01 SG units. Thus, under worst case conditions, the net cumulative error in the control of the output specific gravity would be ± 0.022 SG units if Equation 3 is used in its computation.

FIGURE G-18

DEVIATION BETWEEN ALGEBRAIC AND EQ. 3
(Weighted Moving Average)

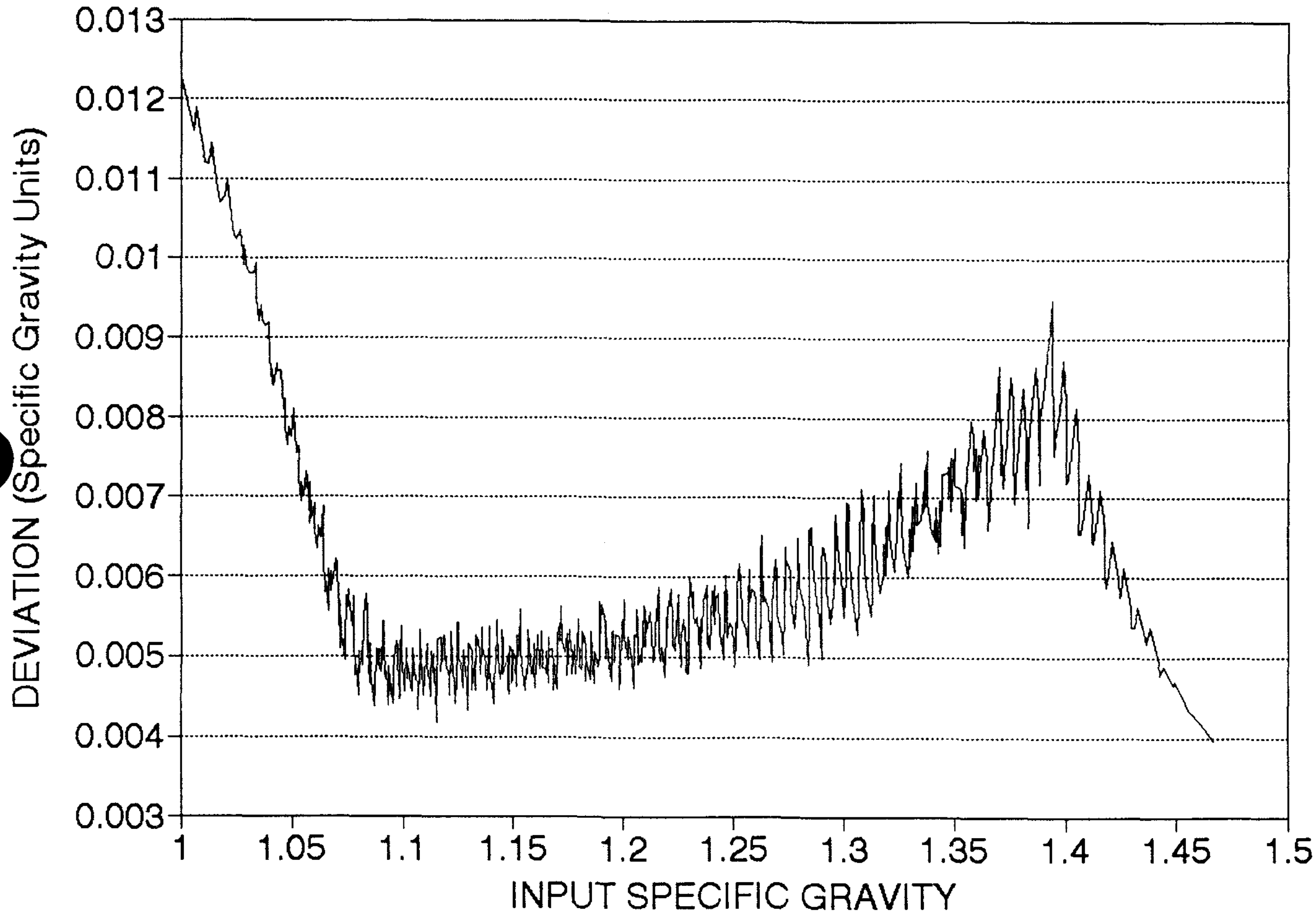


TABLE G-26

DEVIATIONS BETWEEN ALGEBRAIC AND EQUATION 3

SPECIFIC GRAVITY OF POZZOLANS	2.900
SPECIFIC GRAVITY OF SALT	3.251
SPECIFIC GRAVITY OF SILT	2.23
SPECIFIC GRAVITY OF CLAR. SILT	2.73
D (%)	50
W/P RATIO	0.42

TDS %	TSS %	SALT %	CLAR SILT(%)	207C SILT(%)	INPUT SP. GR.	ALGEBRAI OUTPUT S	EQ 3 OUTPUT SG	DEVIATION
0	0	0.00	0	0	1.000	1.857	1.847	0.009
1	0	1.00	0	0	1.007	1.859	1.850	0.009
2	0	2.00	0	0	1.014	1.861	1.852	0.009
3	0	3.00	0	0	1.021	1.864	1.855	0.009
4	0	4.00	0	0	1.028	1.866	1.858	0.009
5	0	5.00	0	0	1.036	1.869	1.860	0.009
6	0	6.00	0	0	1.043	1.872	1.863	0.009
7	0	7.00	0	0	1.051	1.874	1.866	0.008
8	0	8.00	0	0	1.059	1.877	1.869	0.008
9	0	9.00	0	0	1.066	1.880	1.871	0.008
10	0	10.00	0	0	1.074	1.882	1.874	0.008
11	0	11.00	0	0	1.082	1.885	1.877	0.008
12	0	12.00	0	0	1.091	1.888	1.880	0.008
13	0	13.00	0	0	1.099	1.891	1.883	0.008
14	0	14.00	0	0	1.107	1.894	1.886	0.008
15	0	15.00	0	0	1.116	1.897	1.889	0.008
16	0	16.00	0	0	1.125	1.900	1.892	0.008
17	0	17.00	0	0	1.133	1.903	1.896	0.008
18	0	18.00	0	0	1.142	1.906	1.899	0.008
19	0	19.00	0	0	1.151	1.910	1.902	0.008
20	0	20.00	0	0	1.161	1.913	1.905	0.008
21	0	21.00	0	0	1.170	1.917	1.909	0.008
22	0	22.00	0	0	1.180	1.920	1.912	0.008
23	0	23.00	0	0	1.189	1.924	1.916	0.008
24	0	24.00	0	0	1.199	1.927	1.919	0.008
25	0	25.00	0	0	1.209	1.931	1.923	0.008
26	0	26.00	0	0	1.220	1.935	1.927	0.008
27	0	27.00	0	0	1.230	1.939	1.930	0.008
28	0	28.00	0	0	1.240	1.943	1.934	0.008
29	0	29.00	0	0	1.251	1.947	1.938	0.008
30	0	30.00	0	0	1.262	1.951	1.942	0.009
31	0	31.00	0	0	1.273	1.955	1.946	0.009

32	0	32.00	0	0	1.285	1.959	1.950	0.009
33	0	33.00	0	0	1.296	1.964	1.954	0.009
34	0	34.00	0	0	1.308	1.968	1.959	0.010
35	0	35.00	0	0	1.320	1.973	1.963	0.010
36	0	36.00	0	0	1.332	1.978	1.967	0.010
37	0	37.00	0	0	1.344	1.982	1.972	0.011
38	0	38.00	0	0	1.357	1.987	1.976	0.011
39	0	39.00	0	0	1.370	1.993	1.981	0.012
40	0	40.00	0	0	1.383	1.998	1.986	0.012
0	1	0.00	0.5	0.5	1.006	1.858	1.849	0.009
1	1	0.99	0.5	0.5	1.013	1.860	1.852	0.008
2	1	1.98	0.5	0.5	1.020	1.863	1.855	0.008
3	1	2.97	0.5	0.5	1.027	1.865	1.857	0.008
4	1	3.96	0.5	0.5	1.034	1.868	1.860	0.008
5	1	4.95	0.5	0.5	1.042	1.870	1.862	0.008
6	1	5.94	0.5	0.5	1.049	1.873	1.865	0.008
7	1	6.93	0.5	0.5	1.057	1.876	1.868	0.008
8	1	7.92	0.5	0.5	1.065	1.878	1.871	0.008
9	1	8.91	0.5	0.5	1.073	1.881	1.874	0.007
10	1	9.90	0.5	0.5	1.080	1.884	1.876	0.007
11	1	10.89	0.5	0.5	1.089	1.887	1.879	0.007
12	1	11.88	0.5	0.5	1.097	1.889	1.882	0.007
13	1	12.87	0.5	0.5	1.105	1.892	1.885	0.007
14	1	13.86	0.5	0.5	1.113	1.895	1.888	0.007
15	1	14.85	0.5	0.5	1.122	1.898	1.891	0.007
16	1	15.84	0.5	0.5	1.131	1.902	1.895	0.007
17	1	16.83	0.5	0.5	1.140	1.905	1.898	0.007
18	1	17.82	0.5	0.5	1.149	1.908	1.901	0.007
19	1	18.81	0.5	0.5	1.158	1.911	1.904	0.007
20	1	19.80	0.5	0.5	1.167	1.915	1.908	0.007
21	1	20.79	0.5	0.5	1.176	1.918	1.911	0.007
22	1	21.78	0.5	0.5	1.186	1.922	1.914	0.007
23	1	22.77	0.5	0.5	1.196	1.925	1.918	0.007
24	1	23.76	0.5	0.5	1.205	1.929	1.922	0.007
25	1	24.75	0.5	0.5	1.216	1.932	1.925	0.007
26	1	25.74	0.5	0.5	1.226	1.936	1.929	0.007
27	1	26.73	0.5	0.5	1.236	1.940	1.933	0.007
28	1	27.72	0.5	0.5	1.247	1.944	1.936	0.008
29	1	28.71	0.5	0.5	1.257	1.948	1.940	0.008
30	1	29.70	0.5	0.5	1.268	1.952	1.944	0.008
31	1	30.69	0.5	0.5	1.279	1.956	1.948	0.008
32	1	31.68	0.5	0.5	1.291	1.961	1.952	0.008
33	1	32.67	0.5	0.5	1.302	1.965	1.957	0.009
34	1	33.66	0.5	0.5	1.314	1.970	1.961	0.009
35	1	34.65	0.5	0.5	1.326	1.974	1.965	0.009

36	1	35.64	0.5	0.5	1.338	1.979	1.970	0.010
37	1	36.63	0.5	0.5	1.351	1.984	1.974	0.010
38	1	37.62	0.5	0.5	1.363	1.989	1.979	0.010
39	1	38.61	0.5	0.5	1.376	1.994	1.983	0.011
40	1	39.60	0.5	0.5	1.389	1.999	1.988	0.011
0	2	0.00	1	1	1.012	1.859	1.852	0.008
1	2	0.98	1	1	1.019	1.862	1.854	0.008
2	2	1.96	1	1	1.026	1.864	1.857	0.007
3	2	2.94	1	1	1.033	1.867	1.859	0.007
4	2	3.92	1	1	1.041	1.869	1.862	0.007
5	2	4.90	1	1	1.048	1.872	1.865	0.007
6	2	5.88	1	1	1.055	1.874	1.867	0.007
7	2	6.86	1	1	1.063	1.877	1.870	0.007
8	2	7.84	1	1	1.071	1.880	1.873	0.007
9	2	8.82	1	1	1.079	1.882	1.876	0.007
10	2	9.80	1	1	1.087	1.885	1.879	0.007
11	2	10.78	1	1	1.095	1.888	1.882	0.006
12	2	11.76	1	1	1.103	1.891	1.885	0.006
13	2	12.74	1	1	1.111	1.894	1.888	0.006
14	2	13.72	1	1	1.120	1.897	1.891	0.006
15	2	14.70	1	1	1.128	1.900	1.894	0.006
16	2	15.68	1	1	1.137	1.903	1.897	0.006
17	2	16.66	1	1	1.146	1.906	1.900	0.006
18	2	17.64	1	1	1.155	1.909	1.903	0.006
19	2	18.62	1	1	1.164	1.913	1.907	0.006
20	2	19.60	1	1	1.173	1.916	1.910	0.006
21	2	20.58	1	1	1.183	1.920	1.913	0.006
22	2	21.56	1	1	1.192	1.923	1.917	0.006
23	2	22.54	1	1	1.202	1.927	1.920	0.006
24	2	23.52	1	1	1.212	1.930	1.924	0.006
25	2	24.50	1	1	1.222	1.934	1.927	0.006
26	2	25.48	1	1	1.232	1.938	1.931	0.007
27	2	26.46	1	1	1.242	1.942	1.935	0.007
28	2	27.44	1	1	1.253	1.946	1.939	0.007
29	2	28.42	1	1	1.264	1.950	1.943	0.007
30	2	29.40	1	1	1.275	1.954	1.947	0.007
31	2	30.38	1	1	1.286	1.958	1.951	0.007
32	2	31.36	1	1	1.297	1.962	1.955	0.008
33	2	32.34	1	1	1.309	1.967	1.959	0.008
34	2	33.32	1	1	1.320	1.971	1.963	0.008
35	2	34.30	1	1	1.332	1.976	1.967	0.009
36	2	35.28	1	1	1.344	1.981	1.972	0.009
37	2	36.26	1	1	1.357	1.986	1.976	0.009
38	2	37.24	1	1	1.369	1.991	1.981	0.010
39	2	38.22	1	1	1.382	1.996	1.985	0.010

40	2	39.20	1	1	1.395	2.001	1.990	0.011
0	3	0.00	1.5	1.5	1.018	1.861	1.854	0.007
1	3	0.97	1.5	1.5	1.025	1.863	1.856	0.007
2	3	1.94	1.5	1.5	1.032	1.866	1.859	0.007
3	3	2.91	1.5	1.5	1.039	1.868	1.862	0.006
4	3	3.88	1.5	1.5	1.047	1.871	1.864	0.006
5	3	4.85	1.5	1.5	1.054	1.873	1.867	0.006
6	3	5.82	1.5	1.5	1.062	1.876	1.870	0.006
7	3	6.79	1.5	1.5	1.069	1.878	1.872	0.006
8	3	7.76	1.5	1.5	1.077	1.881	1.875	0.006
9	3	8.73	1.5	1.5	1.085	1.884	1.878	0.006
10	3	9.70	1.5	1.5	1.093	1.887	1.881	0.006
11	3	10.67	1.5	1.5	1.101	1.889	1.884	0.006
12	3	11.64	1.5	1.5	1.109	1.892	1.887	0.006
13	3	12.61	1.5	1.5	1.117	1.895	1.890	0.006
14	3	13.58	1.5	1.5	1.126	1.898	1.893	0.005
15	3	14.55	1.5	1.5	1.134	1.901	1.896	0.005
16	3	15.52	1.5	1.5	1.143	1.904	1.899	0.005
17	3	16.49	1.5	1.5	1.152	1.908	1.902	0.005
18	3	17.46	1.5	1.5	1.161	1.911	1.906	0.005
19	3	18.43	1.5	1.5	1.170	1.914	1.909	0.005
20	3	19.40	1.5	1.5	1.179	1.918	1.912	0.005
21	3	20.37	1.5	1.5	1.189	1.921	1.916	0.005
22	3	21.34	1.5	1.5	1.198	1.925	1.919	0.006
23	3	22.31	1.5	1.5	1.208	1.928	1.923	0.006
24	3	23.28	1.5	1.5	1.218	1.932	1.926	0.006
25	3	24.25	1.5	1.5	1.228	1.935	1.930	0.006
26	3	25.22	1.5	1.5	1.238	1.939	1.933	0.006
27	3	26.19	1.5	1.5	1.249	1.943	1.937	0.006
28	3	27.16	1.5	1.5	1.259	1.947	1.941	0.006
29	3	28.13	1.5	1.5	1.270	1.951	1.945	0.006
30	3	29.10	1.5	1.5	1.281	1.955	1.949	0.007
31	3	30.07	1.5	1.5	1.292	1.960	1.953	0.007
32	3	31.04	1.5	1.5	1.303	1.964	1.957	0.007
33	3	32.01	1.5	1.5	1.315	1.968	1.961	0.007
34	3	32.98	1.5	1.5	1.326	1.973	1.965	0.008
35	3	33.95	1.5	1.5	1.338	1.978	1.970	0.008
36	3	34.92	1.5	1.5	1.351	1.982	1.974	0.008
37	3	35.89	1.5	1.5	1.363	1.987	1.978	0.009
38	3	36.86	1.5	1.5	1.376	1.992	1.983	0.009
39	3	37.83	1.5	1.5	1.388	1.997	1.988	0.010
40	3	38.80	1.5	1.5	1.401	2.002	1.992	0.010
0	4	0.00	2	2	1.024	1.862	1.856	0.006
1	4	0.96	2	2	1.031	1.865	1.859	0.006
2	4	1.92	2	2	1.038	1.867	1.861	0.006

3	4	2.88	2	2	1.046	1.869	1.864	0.006
4	4	3.84	2	2	1.053	1.872	1.866	0.006
5	4	4.80	2	2	1.060	1.875	1.869	0.005
6	4	5.76	2	2	1.068	1.877	1.872	0.005
7	4	6.72	2	2	1.076	1.880	1.875	0.005
8	4	7.68	2	2	1.083	1.883	1.877	0.005
9	4	8.64	2	2	1.091	1.885	1.880	0.005
10	4	9.60	2	2	1.099	1.888	1.883	0.005
11	4	10.56	2	2	1.107	1.891	1.886	0.005
12	4	11.52	2	2	1.115	1.894	1.889	0.005
13	4	12.48	2	2	1.124	1.897	1.892	0.005
14	4	13.44	2	2	1.132	1.900	1.895	0.005
15	4	14.40	2	2	1.141	1.903	1.898	0.005
16	4	15.36	2	2	1.150	1.906	1.901	0.005
17	4	16.32	2	2	1.158	1.909	1.905	0.005
18	4	17.28	2	2	1.167	1.912	1.908	0.005
19	4	18.24	2	2	1.176	1.916	1.911	0.005
20	4	19.20	2	2	1.186	1.919	1.914	0.005
21	4	20.16	2	2	1.195	1.923	1.918	0.005
22	4	21.12	2	2	1.205	1.926	1.921	0.005
23	4	22.08	2	2	1.214	1.930	1.925	0.005
24	4	23.04	2	2	1.224	1.933	1.928	0.005
25	4	24.00	2	2	1.234	1.937	1.932	0.005
26	4	24.96	2	2	1.245	1.941	1.936	0.005
27	4	25.92	2	2	1.255	1.945	1.939	0.005
28	4	26.88	2	2	1.266	1.949	1.943	0.005
29	4	27.84	2	2	1.276	1.953	1.947	0.006
30	4	28.80	2	2	1.287	1.957	1.951	0.006
31	4	29.76	2	2	1.298	1.961	1.955	0.006
32	4	30.72	2	2	1.310	1.966	1.959	0.006
33	4	31.68	2	2	1.321	1.970	1.963	0.007
34	4	32.64	2	2	1.333	1.974	1.968	0.007
35	4	33.60	2	2	1.345	1.979	1.972	0.007
36	4	34.56	2	2	1.357	1.984	1.976	0.008
37	4	35.52	2	2	1.369	1.989	1.981	0.008
38	4	36.48	2	2	1.382	1.994	1.985	0.008
39	4	37.44	2	2	1.395	1.999	1.990	0.009
40	4	38.40	2	2	1.408	2.004	1.995	0.009
0	5	0.00	2.5	2.5	1.031	1.864	1.858	0.005
1	5	0.95	2.5	2.5	1.038	1.866	1.861	0.005
2	5	1.90	2.5	2.5	1.045	1.868	1.863	0.005
3	5	2.85	2.5	2.5	1.052	1.871	1.866	0.005
4	5	3.80	2.5	2.5	1.059	1.873	1.869	0.005
5	5	4.75	2.5	2.5	1.067	1.876	1.871	0.005
6	5	5.70	2.5	2.5	1.074	1.879	1.874	0.004

7	5	6.65	2.5	2.5	1.082	1.881	1.877	0.004
8	5	7.60	2.5	2.5	1.090	1.884	1.880	0.004
9	5	8.55	2.5	2.5	1.097	1.887	1.883	0.004
10	5	9.50	2.5	2.5	1.105	1.890	1.885	0.004
11	5	10.45	2.5	2.5	1.114	1.892	1.888	0.004
12	5	11.40	2.5	2.5	1.122	1.895	1.891	0.004
13	5	12.35	2.5	2.5	1.130	1.898	1.894	0.004
14	5	13.30	2.5	2.5	1.139	1.901	1.897	0.004
15	5	14.25	2.5	2.5	1.147	1.904	1.901	0.004
16	5	15.20	2.5	2.5	1.156	1.908	1.904	0.004
17	5	16.15	2.5	2.5	1.165	1.911	1.907	0.004
18	5	17.10	2.5	2.5	1.174	1.914	1.910	0.004
19	5	18.05	2.5	2.5	1.183	1.917	1.913	0.004
20	5	19.00	2.5	2.5	1.192	1.921	1.917	0.004
21	5	19.95	2.5	2.5	1.202	1.924	1.920	0.004
22	5	20.90	2.5	2.5	1.211	1.928	1.924	0.004
23	5	21.85	2.5	2.5	1.221	1.931	1.927	0.004
24	5	22.80	2.5	2.5	1.231	1.935	1.931	0.004
25	5	23.75	2.5	2.5	1.241	1.939	1.934	0.004
26	5	24.70	2.5	2.5	1.251	1.942	1.938	0.004
27	5	25.65	2.5	2.5	1.261	1.946	1.942	0.005
28	5	26.60	2.5	2.5	1.272	1.950	1.946	0.005
29	5	27.55	2.5	2.5	1.283	1.954	1.949	0.005
30	5	28.50	2.5	2.5	1.294	1.959	1.953	0.005
31	5	29.45	2.5	2.5	1.305	1.963	1.957	0.005
32	5	30.40	2.5	2.5	1.316	1.967	1.962	0.006
33	5	31.35	2.5	2.5	1.327	1.972	1.966	0.006
34	5	32.30	2.5	2.5	1.339	1.976	1.970	0.006
35	5	33.25	2.5	2.5	1.351	1.981	1.974	0.007
36	5	34.20	2.5	2.5	1.363	1.986	1.979	0.007
37	5	35.15	2.5	2.5	1.376	1.990	1.983	0.007
38	5	36.10	2.5	2.5	1.388	1.995	1.988	0.008
39	5	37.05	2.5	2.5	1.401	2.000	1.992	0.008
40	5	38.00	2.5	2.5	1.414	2.006	1.997	0.009
0	6	0.00	3	3	1.037	1.865	1.861	0.004
1	6	0.94	3	3	1.044	1.867	1.863	0.004
2	6	1.88	3	3	1.051	1.870	1.866	0.004
3	6	2.82	3	3	1.058	1.872	1.868	0.004
4	6	3.76	3	3	1.066	1.875	1.871	0.004
5	6	4.70	3	3	1.073	1.878	1.874	0.004
6	6	5.64	3	3	1.081	1.880	1.876	0.004
7	6	6.58	3	3	1.088	1.883	1.879	0.004
8	6	7.52	3	3	1.096	1.886	1.882	0.003
9	6	8.46	3	3	1.104	1.888	1.885	0.003
10	6	9.40	3	3	1.112	1.891	1.888	0.003

11	6	10.34	3	3	1.120	1.894	1.891	0.003
12	6	11.28	3	3	1.128	1.897	1.894	0.003
13	6	12.22	3	3	1.137	1.900	1.897	0.003
14	6	13.16	3	3	1.145	1.903	1.900	0.003
15	6	14.10	3	3	1.154	1.906	1.903	0.003
16	6	15.04	3	3	1.162	1.909	1.906	0.003
17	6	15.98	3	3	1.171	1.912	1.909	0.003
18	6	16.92	3	3	1.180	1.916	1.912	0.003
19	6	17.86	3	3	1.189	1.919	1.916	0.003
20	6	18.80	3	3	1.199	1.922	1.919	0.003
21	6	19.74	3	3	1.208	1.926	1.923	0.003
22	6	20.68	3	3	1.218	1.929	1.926	0.003
23	6	21.62	3	3	1.227	1.933	1.930	0.003
24	6	22.56	3	3	1.237	1.936	1.933	0.003
25	6	23.50	3	3	1.247	1.940	1.937	0.004
26	6	24.44	3	3	1.258	1.944	1.940	0.004
27	6	25.38	3	3	1.268	1.948	1.944	0.004
28	6	26.32	3	3	1.278	1.952	1.948	0.004
29	6	27.26	3	3	1.289	1.956	1.952	0.004
30	6	28.20	3	3	1.300	1.960	1.956	0.004
31	6	29.14	3	3	1.311	1.964	1.960	0.005
32	6	30.08	3	3	1.322	1.969	1.964	0.005
33	6	31.02	3	3	1.334	1.973	1.968	0.005
34	6	31.96	3	3	1.346	1.978	1.972	0.006
35	6	32.90	3	3	1.358	1.982	1.977	0.006
36	6	33.84	3	3	1.370	1.987	1.981	0.006
37	6	34.78	3	3	1.382	1.992	1.985	0.007
38	6	35.72	3	3	1.394	1.997	1.990	0.007
39	6	36.66	3	3	1.407	2.002	1.995	0.008
40	6	37.60	3	3	1.420	2.007	1.999	0.008
0	7	0.00	3.5	3.5	1.043	1.867	1.863	0.004
1	7	0.93	3.5	3.5	1.050	1.869	1.866	0.003
2	7	1.86	3.5	3.5	1.057	1.871	1.868	0.003
3	7	2.79	3.5	3.5	1.065	1.874	1.871	0.003
4	7	3.72	3.5	3.5	1.072	1.876	1.873	0.003
5	7	4.65	3.5	3.5	1.080	1.879	1.876	0.003
6	7	5.58	3.5	3.5	1.087	1.882	1.879	0.003
7	7	6.51	3.5	3.5	1.095	1.884	1.882	0.003
8	7	7.44	3.5	3.5	1.103	1.887	1.884	0.003
9	7	8.37	3.5	3.5	1.110	1.890	1.887	0.003
10	7	9.30	3.5	3.5	1.118	1.893	1.890	0.003
11	7	10.23	3.5	3.5	1.127	1.896	1.893	0.002
12	7	11.16	3.5	3.5	1.135	1.898	1.896	0.002
13	7	12.09	3.5	3.5	1.143	1.901	1.899	0.002
14	7	13.02	3.5	3.5	1.152	1.904	1.902	0.002

15	7	13.95	3.5	3.5	1.160	1.908	1.905	0.002
16	7	14.88	3.5	3.5	1.169	1.911	1.908	0.002
17	7	15.81	3.5	3.5	1.178	1.914	1.912	0.002
18	7	16.74	3.5	3.5	1.187	1.917	1.915	0.002
19	7	17.67	3.5	3.5	1.196	1.920	1.918	0.002
20	7	18.60	3.5	3.5	1.205	1.924	1.921	0.002
21	7	19.53	3.5	3.5	1.215	1.927	1.925	0.002
22	7	20.46	3.5	3.5	1.224	1.931	1.928	0.002
23	7	21.39	3.5	3.5	1.234	1.934	1.932	0.003
24	7	22.32	3.5	3.5	1.244	1.938	1.935	0.003
25	7	23.25	3.5	3.5	1.254	1.942	1.939	0.003
26	7	24.18	3.5	3.5	1.264	1.946	1.943	0.003
27	7	25.11	3.5	3.5	1.274	1.950	1.947	0.003
28	7	26.04	3.5	3.5	1.285	1.954	1.950	0.003
29	7	26.97	3.5	3.5	1.296	1.958	1.954	0.003
30	7	27.90	3.5	3.5	1.307	1.962	1.958	0.004
31	7	28.83	3.5	3.5	1.318	1.966	1.962	0.004
32	7	29.76	3.5	3.5	1.329	1.970	1.966	0.004
33	7	30.69	3.5	3.5	1.340	1.975	1.970	0.004
34	7	31.62	3.5	3.5	1.352	1.979	1.975	0.005
35	7	32.55	3.5	3.5	1.364	1.984	1.979	0.005
36	7	33.48	3.5	3.5	1.376	1.989	1.983	0.006
37	7	34.41	3.5	3.5	1.388	1.994	1.988	0.006
38	7	35.34	3.5	3.5	1.401	1.999	1.992	0.006
39	7	36.27	3.5	3.5	1.414	2.004	1.997	0.007
40	7	37.20	3.5	3.5	1.427	2.009	2.002	0.007
0	8	0.00	4	4	1.050	1.868	1.865	0.003
1	8	0.92	4	4	1.057	1.870	1.868	0.003
2	8	1.84	4	4	1.064	1.873	1.870	0.002
3	8	2.76	4	4	1.071	1.875	1.873	0.002
4	8	3.68	4	4	1.079	1.878	1.876	0.002
5	8	4.60	4	4	1.086	1.881	1.878	0.002
6	8	5.52	4	4	1.094	1.883	1.881	0.002
7	8	6.44	4	4	1.101	1.886	1.884	0.002
8	8	7.36	4	4	1.109	1.889	1.887	0.002
9	8	8.28	4	4	1.117	1.891	1.890	0.002
10	8	9.20	4	4	1.125	1.894	1.892	0.002
11	8	10.12	4	4	1.133	1.897	1.895	0.002
12	8	11.04	4	4	1.141	1.900	1.898	0.002
13	8	11.96	4	4	1.150	1.903	1.901	0.002
14	8	12.88	4	4	1.158	1.906	1.904	0.002
15	8	13.80	4	4	1.167	1.909	1.908	0.002
16	8	14.72	4	4	1.176	1.912	1.911	0.001
17	8	15.64	4	4	1.184	1.915	1.914	0.001
18	8	16.56	4	4	1.193	1.919	1.917	0.002

19	8	17.48	4	4	1.203	1.922	1.921	0.002
20	8	18.40	4	4	1.212	1.925	1.924	0.002
21	8	19.32	4	4	1.221	1.929	1.927	0.002
22	8	20.24	4	4	1.231	1.932	1.931	0.002
23	8	21.16	4	4	1.241	1.936	1.934	0.002
24	8	22.08	4	4	1.250	1.940	1.938	0.002
25	8	23.00	4	4	1.260	1.944	1.941	0.002
26	8	23.92	4	4	1.271	1.947	1.945	0.002
27	8	24.84	4	4	1.281	1.951	1.949	0.002
28	8	25.76	4	4	1.292	1.955	1.953	0.003
29	8	26.68	4	4	1.302	1.959	1.957	0.003
30	8	27.60	4	4	1.313	1.963	1.961	0.003
31	8	28.52	4	4	1.324	1.968	1.965	0.003
32	8	29.44	4	4	1.336	1.972	1.969	0.003
33	8	30.36	4	4	1.347	1.977	1.973	0.004
34	8	31.28	4	4	1.359	1.981	1.977	0.004
35	8	32.20	4	4	1.371	1.986	1.981	0.004
36	8	33.12	4	4	1.383	1.991	1.986	0.005
37	8	34.04	4	4	1.395	1.995	1.990	0.005
38	8	34.96	4	4	1.407	2.000	1.995	0.006
39	8	35.88	4	4	1.420	2.005	1.999	0.006
40	8	36.80	4	4	1.433	2.011	2.004	0.007
0	9	0.00	4.5	4.5	1.056	1.870	1.868	0.002
1	9	0.91	4.5	4.5	1.063	1.872	1.870	0.002
2	9	1.82	4.5	4.5	1.071	1.874	1.873	0.002
3	9	2.73	4.5	4.5	1.078	1.877	1.875	0.002
4	9	3.64	4.5	4.5	1.085	1.880	1.878	0.001
5	9	4.55	4.5	4.5	1.093	1.882	1.881	0.001
6	9	5.46	4.5	4.5	1.100	1.885	1.884	0.001
7	9	6.37	4.5	4.5	1.108	1.887	1.886	0.001
8	9	7.28	4.5	4.5	1.116	1.890	1.889	0.001
9	9	8.19	4.5	4.5	1.124	1.893	1.892	0.001
10	9	9.10	4.5	4.5	1.132	1.896	1.895	0.001
11	9	10.01	4.5	4.5	1.140	1.899	1.898	0.001
12	9	10.92	4.5	4.5	1.148	1.902	1.901	0.001
13	9	11.83	4.5	4.5	1.156	1.905	1.904	0.001
14	9	12.74	4.5	4.5	1.165	1.908	1.907	0.001
15	9	13.65	4.5	4.5	1.174	1.911	1.910	0.001
16	9	14.56	4.5	4.5	1.182	1.914	1.913	0.001
17	9	15.47	4.5	4.5	1.191	1.917	1.916	0.001
18	9	16.38	4.5	4.5	1.200	1.920	1.920	0.001
19	9	17.29	4.5	4.5	1.209	1.924	1.923	0.001
20	9	18.20	4.5	4.5	1.219	1.927	1.926	0.001
21	9	19.11	4.5	4.5	1.228	1.931	1.930	0.001
22	9	20.02	4.5	4.5	1.238	1.934	1.933	0.001

23	9	20.93	4.5	4.5	1.247	1.938	1.937	0.001
24	9	21.84	4.5	4.5	1.257	1.941	1.940	0.001
25	9	22.75	4.5	4.5	1.267	1.945	1.944	0.001
26	9	23.66	4.5	4.5	1.277	1.949	1.948	0.001
27	9	24.57	4.5	4.5	1.288	1.953	1.951	0.002
28	9	25.48	4.5	4.5	1.298	1.957	1.955	0.002
29	9	26.39	4.5	4.5	1.309	1.961	1.959	0.002
30	9	27.30	4.5	4.5	1.320	1.965	1.963	0.002
31	9	28.21	4.5	4.5	1.331	1.969	1.967	0.003
32	9	29.12	4.5	4.5	1.342	1.974	1.971	0.003
33	9	30.03	4.5	4.5	1.354	1.978	1.975	0.003
34	9	30.94	4.5	4.5	1.365	1.983	1.979	0.003
35	9	31.85	4.5	4.5	1.377	1.987	1.984	0.004
36	9	32.76	4.5	4.5	1.389	1.992	1.988	0.004
37	9	33.67	4.5	4.5	1.401	1.997	1.992	0.005
38	9	34.58	4.5	4.5	1.414	2.002	1.997	0.005
39	9	35.49	4.5	4.5	1.427	2.007	2.002	0.006
40	9	36.40	4.5	4.5	1.440	2.012	2.006	0.006
0	10	0.00	5	5	1.063	1.871	1.870	0.001
1	10	0.90	5	5	1.070	1.874	1.873	0.001
2	10	1.80	5	5	1.077	1.876	1.875	0.001
3	10	2.70	5	5	1.085	1.879	1.878	0.001
4	10	3.60	5	5	1.092	1.881	1.881	0.001
5	10	4.50	5	5	1.099	1.884	1.883	0.000
6	10	5.40	5	5	1.107	1.886	1.886	0.000
7	10	6.30	5	5	1.115	1.889	1.889	0.000
8	10	7.20	5	5	1.122	1.892	1.892	0.000
9	10	8.10	5	5	1.130	1.895	1.894	0.000
10	10	9.00	5	5	1.138	1.897	1.897	0.000
11	10	9.90	5	5	1.147	1.900	1.900	0.000
12	10	10.80	5	5	1.155	1.903	1.903	0.000
13	10	11.70	5	5	1.163	1.906	1.906	0.000
14	10	12.60	5	5	1.172	1.909	1.909	0.000
15	10	13.50	5	5	1.180	1.912	1.912	0.000
16	10	14.40	5	5	1.189	1.916	1.916	0.000
17	10	15.30	5	5	1.198	1.919	1.919	0.000
18	10	16.20	5	5	1.207	1.922	1.922	0.000
19	10	17.10	5	5	1.216	1.925	1.925	0.000
20	10	18.00	5	5	1.225	1.929	1.929	0.000
21	10	18.90	5	5	1.235	1.932	1.932	0.000
22	10	19.80	5	5	1.244	1.936	1.936	0.000
23	10	20.70	5	5	1.254	1.939	1.939	0.000
24	10	21.60	5	5	1.264	1.943	1.943	0.000
25	10	22.50	5	5	1.274	1.947	1.946	0.001
26	10	23.40	5	5	1.284	1.951	1.950	0.001

27	10	24.30	5	5	1.295	1.955	1.954	0.001
28	10	25.20	5	5	1.305	1.959	1.958	0.001
29	10	26.10	5	5	1.316	1.963	1.961	0.001
30	10	27.00	5	5	1.327	1.967	1.965	0.002
31	10	27.90	5	5	1.338	1.971	1.969	0.002
32	10	28.80	5	5	1.349	1.976	1.973	0.002
33	10	29.70	5	5	1.360	1.980	1.978	0.002
34	10	30.60	5	5	1.372	1.985	1.982	0.003
35	10	31.50	5	5	1.384	1.989	1.986	0.003
36	10	32.40	5	5	1.396	1.994	1.990	0.004
37	10	33.30	5	5	1.408	1.999	1.995	0.004
38	10	34.20	5	5	1.421	2.004	1.999	0.004
39	10	35.10	5	5	1.433	2.009	2.004	0.005
40	10	36.00	5	5	1.446	2.014	2.009	0.006
0	11	0.00	5.5	5.5	1.070	1.873	1.873	0.000
1	11	0.89	5.5	5.5	1.077	1.875	1.875	0.000
2	11	1.78	5.5	5.5	1.084	1.878	1.878	0.000
3	11	2.67	5.5	5.5	1.091	1.880	1.880	0.000
4	11	3.56	5.5	5.5	1.099	1.883	1.883	0.000
5	11	4.45	5.5	5.5	1.106	1.885	1.886	0.000
6	11	5.34	5.5	5.5	1.114	1.888	1.888	0.000
7	11	6.23	5.5	5.5	1.121	1.891	1.891	0.001
8	11	7.12	5.5	5.5	1.129	1.893	1.894	0.001
9	11	8.01	5.5	5.5	1.137	1.896	1.897	0.001
10	11	8.90	5.5	5.5	1.145	1.899	1.900	0.001
11	11	9.79	5.5	5.5	1.153	1.902	1.903	0.001
12	11	10.68	5.5	5.5	1.162	1.905	1.906	0.001
13	11	11.57	5.5	5.5	1.170	1.908	1.909	0.001
14	11	12.46	5.5	5.5	1.178	1.911	1.912	0.001
15	11	13.35	5.5	5.5	1.187	1.914	1.915	0.001
16	11	14.24	5.5	5.5	1.196	1.917	1.918	0.001
17	11	15.13	5.5	5.5	1.205	1.920	1.921	0.001
18	11	16.02	5.5	5.5	1.214	1.924	1.925	0.001
19	11	16.91	5.5	5.5	1.223	1.927	1.928	0.001
20	11	17.80	5.5	5.5	1.232	1.931	1.931	0.001
21	11	18.69	5.5	5.5	1.242	1.934	1.935	0.001
22	11	19.58	5.5	5.5	1.251	1.938	1.938	0.001
23	11	20.47	5.5	5.5	1.261	1.941	1.942	0.000
24	11	21.36	5.5	5.5	1.271	1.945	1.945	0.000
25	11	22.25	5.5	5.5	1.281	1.949	1.949	0.000
26	11	23.14	5.5	5.5	1.291	1.952	1.952	0.000
27	11	24.03	5.5	5.5	1.301	1.956	1.956	0.000
28	11	24.92	5.5	5.5	1.312	1.960	1.960	0.000
29	11	25.81	5.5	5.5	1.323	1.964	1.964	0.001
30	11	26.70	5.5	5.5	1.333	1.969	1.968	0.001

31	11	27.59	5.5	5.5	1.344	1.973	1.972	0.001
32	11	28.48	5.5	5.5	1.356	1.977	1.976	0.001
33	11	29.37	5.5	5.5	1.367	1.982	1.980	0.002
34	11	30.26	5.5	5.5	1.379	1.986	1.984	0.002
35	11	31.15	5.5	5.5	1.391	1.991	1.988	0.002
36	11	32.04	5.5	5.5	1.403	1.996	1.993	0.003
37	11	32.93	5.5	5.5	1.415	2.001	1.997	0.003
38	11	33.82	5.5	5.5	1.427	2.006	2.002	0.004
39	11	34.71	5.5	5.5	1.440	2.011	2.006	0.004
40	11	35.60	5.5	5.5	1.453	2.016	2.011	0.005
0	12	0.00	6	6	1.077	1.874	1.875	0.001
1	12	0.88	6	6	1.084	1.877	1.878	0.001
2	12	1.76	6	6	1.091	1.879	1.880	0.001
3	12	2.64	6	6	1.098	1.882	1.883	0.001
4	12	3.52	6	6	1.106	1.884	1.885	0.001
5	12	4.40	6	6	1.113	1.887	1.888	0.001
6	12	5.28	6	6	1.121	1.890	1.891	0.001
7	12	6.16	6	6	1.128	1.892	1.894	0.001
8	12	7.04	6	6	1.136	1.895	1.897	0.001
9	12	7.92	6	6	1.144	1.898	1.899	0.002
10	12	8.80	6	6	1.152	1.901	1.902	0.002
11	12	9.68	6	6	1.160	1.904	1.905	0.002
12	12	10.56	6	6	1.169	1.907	1.908	0.002
13	12	11.44	6	6	1.177	1.910	1.911	0.002
14	12	12.32	6	6	1.185	1.913	1.914	0.002
15	12	13.20	6	6	1.194	1.916	1.917	0.002
16	12	14.08	6	6	1.203	1.919	1.921	0.002
17	12	14.96	6	6	1.212	1.922	1.924	0.002
18	12	15.84	6	6	1.221	1.925	1.927	0.002
19	12	16.72	6	6	1.230	1.929	1.930	0.002
20	12	17.60	6	6	1.239	1.932	1.934	0.002
21	12	18.48	6	6	1.249	1.936	1.937	0.001
22	12	19.36	6	6	1.258	1.939	1.941	0.001
23	12	20.24	6	6	1.268	1.943	1.944	0.001
24	12	21.12	6	6	1.278	1.947	1.948	0.001
25	12	22.00	6	6	1.288	1.950	1.951	0.001
26	12	22.88	6	6	1.298	1.954	1.955	0.001
27	12	23.76	6	6	1.308	1.958	1.959	0.001
28	12	24.64	6	6	1.319	1.962	1.963	0.000
29	12	25.52	6	6	1.329	1.966	1.966	0.000
30	12	26.40	6	6	1.340	1.970	1.970	0.000
31	12	27.28	6	6	1.351	1.975	1.974	0.000
32	12	28.16	6	6	1.363	1.979	1.978	0.001
33	12	29.04	6	6	1.374	1.984	1.982	0.001
34	12	29.92	6	6	1.386	1.988	1.987	0.001

35	12	30.80	6	6	1.397	1.993	1.991	0.002
36	12	31.68	6	6	1.409	1.998	1.995	0.002
37	12	32.56	6	6	1.422	2.002	2.000	0.003
38	12	33.44	6	6	1.434	2.007	2.004	0.003
39	12	34.32	6	6	1.447	2.012	2.009	0.004
40	12	35.20	6	6	1.460	2.018	2.013	0.004
0	13	0.00	6.5	6.5	1.083	1.876	1.877	0.002
1	13	0.87	6.5	6.5	1.091	1.878	1.880	0.002
2	13	1.74	6.5	6.5	1.098	1.881	1.883	0.002
3	13	2.61	6.5	6.5	1.105	1.883	1.885	0.002
4	13	3.48	6.5	6.5	1.113	1.886	1.888	0.002
5	13	4.35	6.5	6.5	1.120	1.889	1.891	0.002
6	13	5.22	6.5	6.5	1.128	1.891	1.893	0.002
7	13	6.09	6.5	6.5	1.135	1.894	1.896	0.002
8	13	6.96	6.5	6.5	1.143	1.897	1.899	0.002
9	13	7.83	6.5	6.5	1.151	1.900	1.902	0.002
10	13	8.70	6.5	6.5	1.159	1.902	1.905	0.002
11	13	9.57	6.5	6.5	1.167	1.905	1.908	0.002
12	13	10.44	6.5	6.5	1.176	1.908	1.911	0.002
13	13	11.31	6.5	6.5	1.184	1.911	1.914	0.002
14	13	12.18	6.5	6.5	1.192	1.914	1.917	0.002
15	13	13.05	6.5	6.5	1.201	1.918	1.920	0.002
16	13	13.92	6.5	6.5	1.210	1.921	1.923	0.002
17	13	14.79	6.5	6.5	1.219	1.924	1.926	0.002
18	13	15.66	6.5	6.5	1.228	1.927	1.930	0.002
19	13	16.53	6.5	6.5	1.237	1.931	1.933	0.002
20	13	17.40	6.5	6.5	1.246	1.934	1.936	0.002
21	13	18.27	6.5	6.5	1.256	1.937	1.940	0.002
22	13	19.14	6.5	6.5	1.265	1.941	1.943	0.002
23	13	20.01	6.5	6.5	1.275	1.945	1.947	0.002
24	13	20.88	6.5	6.5	1.285	1.948	1.950	0.002
25	13	21.75	6.5	6.5	1.295	1.952	1.954	0.002
26	13	22.62	6.5	6.5	1.305	1.956	1.958	0.002
27	13	23.49	6.5	6.5	1.315	1.960	1.961	0.001
28	13	24.36	6.5	6.5	1.326	1.964	1.965	0.001
29	13	25.23	6.5	6.5	1.336	1.968	1.969	0.001
30	13	26.10	6.5	6.5	1.347	1.972	1.973	0.001
31	13	26.97	6.5	6.5	1.358	1.977	1.977	0.000
32	13	27.84	6.5	6.5	1.370	1.981	1.981	0.000
33	13	28.71	6.5	6.5	1.381	1.985	1.985	0.000
34	13	29.58	6.5	6.5	1.392	1.990	1.989	0.001
35	13	30.45	6.5	6.5	1.404	1.995	1.993	0.001
36	13	31.32	6.5	6.5	1.416	1.999	1.998	0.002
37	13	32.19	6.5	6.5	1.428	2.004	2.002	0.002
38	13	33.06	6.5	6.5	1.441	2.009	2.007	0.003

39	13	33.93	6.5	6.5	1.453	2.014	2.011	0.003
40	13	34.80	6.5	6.5	1.466	2.020	2.016	0.004
0	14	0.00	7	7	1.090	1.878	1.880	0.002
1	14	0.86	7	7	1.098	1.880	1.883	0.002
2	14	1.72	7	7	1.105	1.883	1.885	0.003
3	14	2.58	7	7	1.112	1.885	1.888	0.003
4	14	3.44	7	7	1.120	1.888	1.891	0.003
5	14	4.30	7	7	1.127	1.890	1.893	0.003
6	14	5.16	7	7	1.135	1.893	1.896	0.003
7	14	6.02	7	7	1.142	1.896	1.899	0.003
8	14	6.88	7	7	1.150	1.899	1.902	0.003
9	14	7.74	7	7	1.158	1.901	1.904	0.003
10	14	8.60	7	7	1.166	1.904	1.907	0.003
11	14	9.46	7	7	1.174	1.907	1.910	0.003
12	14	10.32	7	7	1.183	1.910	1.913	0.003
13	14	11.18	7	7	1.191	1.913	1.916	0.003
14	14	12.04	7	7	1.200	1.916	1.919	0.003
15	14	12.90	7	7	1.208	1.919	1.923	0.003
16	14	13.76	7	7	1.217	1.922	1.926	0.003
17	14	14.62	7	7	1.226	1.926	1.929	0.003
18	14	15.48	7	7	1.235	1.929	1.932	0.003
19	14	16.34	7	7	1.244	1.932	1.935	0.003
20	14	17.20	7	7	1.253	1.936	1.939	0.003
21	14	18.06	7	7	1.263	1.939	1.942	0.003
22	14	18.92	7	7	1.272	1.943	1.946	0.003
23	14	19.78	7	7	1.282	1.946	1.949	0.003
24	14	20.64	7	7	1.292	1.950	1.953	0.003
25	14	21.50	7	7	1.302	1.954	1.956	0.002
26	14	22.36	7	7	1.312	1.958	1.960	0.002
27	14	23.22	7	7	1.322	1.962	1.964	0.002
28	14	24.08	7	7	1.333	1.966	1.968	0.002
29	14	24.94	7	7	1.343	1.970	1.971	0.002
30	14	25.80	7	7	1.354	1.974	1.975	0.001
31	14	26.66	7	7	1.365	1.978	1.979	0.001
32	14	27.52	7	7	1.376	1.983	1.983	0.001
33	14	28.38	7	7	1.388	1.987	1.988	0.000
34	14	29.24	7	7	1.399	1.992	1.992	0.000
35	14	30.10	7	7	1.411	1.996	1.996	0.000
36	14	30.96	7	7	1.423	2.001	2.000	0.001
37	14	31.82	7	7	1.435	2.006	2.005	0.001
38	14	32.68	7	7	1.448	2.011	2.009	0.002
39	14	33.54	7	7	1.460	2.016	2.014	0.002
40	14	34.40	7	7	1.473	2.021	2.018	0.003
0	15	0.00	7.5	7.5	1.098	1.879	1.883	0.003
1	15	0.85	7.5	7.5	1.105	1.882	1.885	0.003

2	15	1.70	7.5	7.5	1.112	1.884	1.888	0.003
3	15	2.55	7.5	7.5	1.119	1.887	1.890	0.004
4	15	3.40	7.5	7.5	1.127	1.889	1.893	0.004
5	15	4.25	7.5	7.5	1.134	1.892	1.896	0.004
6	15	5.10	7.5	7.5	1.142	1.895	1.899	0.004
7	15	5.95	7.5	7.5	1.150	1.897	1.901	0.004
8	15	6.80	7.5	7.5	1.157	1.900	1.904	0.004
9	15	7.65	7.5	7.5	1.165	1.903	1.907	0.004
10	15	8.50	7.5	7.5	1.173	1.906	1.910	0.004
11	15	9.35	7.5	7.5	1.182	1.909	1.913	0.004
12	15	10.20	7.5	7.5	1.190	1.912	1.916	0.004
13	15	11.05	7.5	7.5	1.198	1.915	1.919	0.004
14	15	11.90	7.5	7.5	1.207	1.918	1.922	0.004
15	15	12.75	7.5	7.5	1.215	1.921	1.925	0.004
16	15	13.60	7.5	7.5	1.224	1.924	1.928	0.004
17	15	14.45	7.5	7.5	1.233	1.927	1.932	0.004
18	15	15.30	7.5	7.5	1.242	1.931	1.935	0.004
19	15	16.15	7.5	7.5	1.251	1.934	1.938	0.004
20	15	17.00	7.5	7.5	1.260	1.938	1.941	0.004
21	15	17.85	7.5	7.5	1.270	1.941	1.945	0.004
22	15	18.70	7.5	7.5	1.279	1.945	1.948	0.004
23	15	19.55	7.5	7.5	1.289	1.948	1.952	0.003
24	15	20.40	7.5	7.5	1.299	1.952	1.955	0.003
25	15	21.25	7.5	7.5	1.309	1.956	1.959	0.003
26	15	22.10	7.5	7.5	1.319	1.960	1.963	0.003
27	15	22.95	7.5	7.5	1.329	1.964	1.966	0.003
28	15	23.80	7.5	7.5	1.340	1.968	1.970	0.003
29	15	24.65	7.5	7.5	1.351	1.972	1.974	0.002
30	15	25.50	7.5	7.5	1.361	1.976	1.978	0.002
31	15	26.35	7.5	7.5	1.372	1.980	1.982	0.002
32	15	27.20	7.5	7.5	1.384	1.985	1.986	0.001
33	15	28.05	7.5	7.5	1.395	1.989	1.990	0.001
34	15	28.90	7.5	7.5	1.406	1.994	1.994	0.001
35	15	29.75	7.5	7.5	1.418	1.998	1.998	0.000
36	15	30.60	7.5	7.5	1.430	2.003	2.003	0.000
37	15	31.45	7.5	7.5	1.442	2.008	2.007	0.001
38	15	32.30	7.5	7.5	1.455	2.013	2.012	0.001
39	15	33.15	7.5	7.5	1.467	2.018	2.016	0.002
40	15	34.00	7.5	7.5	1.480	2.023	2.021	0.002

AVERAGE DEVIATION	0.004
MAXIMUM DEVIATION	0.012

JRRES. CONTROL
JTGOING LTR NO

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DIST	LTR	ENC
IN, A.		
H.S.		
H, D.B.		
RNIVAL, G.J.		
PP, R.D.		
VIS, J.G.		
ERED, J.E.		
RRERA, D.W.		
ODWIN, R.		
NNI, B.J.		
RMAN, L.K.		
ALY, T.J.		
BIG, J.G.		
KER, E.H.		
RSH, J.M.		
RBY, W.A.		
ESTER, A.W.		
IEG, D.		
E, E.M.		
JESTIC, J.R.		
RX, G.E.		
DONALD, M.M.		
ORGAN, R.V.		
TTER, G.L.		
ZUTO, V.M.		
NDLIN, N.B.		
EPLER, R.L.		
LLIVAN, M.T.		
ANSON, E.R.		
MAN, K.G.		
EBE, J.S.		
KINSON, R.B.		
SON, J.M.		
NE, J.O.		
JRRES CONTROL	x	x

CLASSIFICATION:

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NCLASSIFIED	X	X
ONFIDENTIAL		
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ITHORIZED CLASSIFIER SIGNATURE

7-30-92

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REPLY TO RFP CC NO:

CTION ITEM STATUS
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☐ PARTIAL
APPROVALS:

RIG & TYPIST INITIALS

46469 (Rev. 4/92)

EG&G ROCKY FLATS

EG&G ROCKY FLATS, INC.
ROCKY FLATS PLANT, P.O. BOX 464, GOLDEN, COLORADO 80402-0464 • (303) 966-7000

July 30, 1992 92-RF-8831

Terry A. Vaeth
Manager
DOE, RFO

Attn: Scott Surovchek

APPENDIX H - TREATABILITY STUDY REPORT AND PROCESS FORMULATION REPORT, POND 207C & CLARIFIER SP/DRF-151-92

Enclosed for incorporation into the Treatability Study (Combined Deliverable 235A, 236A and 235E, 236E) as APPENDIX H for 207C Pond/Clarifier is the temperature study.

D. R. Ferrier
Solar Ponds Program Manager

DRF:brw

Orig. and 1 cc - T.A. Vaeth

Enclosure:
As Stated

As Stated

HALLIBURTON NUS
Environmental Corporation

WBS 235 TREATABILITY STUDY REPORT AND PROCESS FORMULATION REPORT FOR POND 207C AND CLARIFIER

APPENDIX H

TEMPERATURE RISE DURING CURING OF CEMENTED 207C AND CLARIFIER WASTE AND ITS EFFECTS

SHAJ A. MATHEW, Ph. D.
HALLIBURTON NUS ENVIRONMENTAL CORPORATION

JULY 1992

W/NW

REVIEWED FOR CLASSIFICATION
By
Date 7-28-92

EG&G ROCKY FLATS

INTEROFFICE CORRESPONDENCE

DATE July 28, 1992

TO Distribution

FROM D.R.Ferrier, Solar Ponds Project Office, Bldg. 750, X6456

SUBJECT WBS 235 & 236 TREATABILITY REPORT AND PROCESS FORMULATION REPORT, POND 207C & CLARIFIER SP/DRF-149-92

Enclosed for incorporation into the Treatability Study (Combined Deliverable 235A,236A, and 235E,236E) as APPENDIX H for 207C Pond/Clarifier is the temperature study.

brw

Distribution:
D. Joseffy
E.F.Lombardi
M. Prochazka

HALLIBURTON NUS
Environmental Corporation

WBS 235 TREATABILITY STUDY REPORT AND PROCESS FORMULATION REPORT FOR POND 207C AND CLARIFIER

APPENDIX H

TEMPERATURE RISE DURING CURING OF CEMENTED 207C AND CLARIFIER WASTE AND ITS EFFECTS

SHAJ A. MATHEW, Ph. D.
HALLIBURTON NUS ENVIRONMENTAL CORPORATION

JULY 1992

236A 236E

HALLIBURTON NUS
Environmental Corporation

Environmental Technologies Group
ROCKY FLATS SOLARPOND/PONDCRETE PROJECT
452 BURBANK STREET
EG&G BUILDING 025
BROOMFIELD, COLORADO 80020
(303) 469-3573
FAX (303) 469-6354

July 22, 1992

JUL 1992
RECEIVED
Pondcrete
Project

Mr. Don Ferrier
Project Manager
EG&G Rocky Flats, Inc.
P. O. Box 464
Room 121A
Golden, Colorado 80402-0464

Subject: Rocky Flats Plant Solar Evaporation Ponds Stabilization Project [WBS 235 & 236 TREATABILITY STUDY REPORT AND PROCESS FORMULATION REPORT, POND 207C & CLARIFIER – HALLIBURTON NUS ROCKY FLATS] – APPENDIX H – TEMPERATURE RISE DURING CURING OF CEMENTED 207C AND CLARIFIER WASTE AND ITS EFFECTS
RF-HED-92-0442

Dear Mr. Ferrier:

Enclosed for incorporation into the Treatability Study as APPENDIX H for 207C Pond/Clarifier is the temperature study. This study was prepared to provide the following information for incorporation into the Process Control Plan (PCP):

1. Material handling requirements for transporting freshly cast material.

2. Determination that a "no free water" condition can be achieved by casting the material into a bladder and evacuating any air from the bladder.

3. Demonstrate that laboratory results can be applied to a full scale test with successful results.

Among the half crates prepared during this study were those cast during the field demonstration test witnessed by EG&G and DOE on May 28, 1992. Each of the castings was visually inspected after curing and cored to provide visual, physical, and chemical/analytical data. All the halfcrates exhibited no free water in the product or the packaging, and insignificant free particulates. Testing performed using a surrogate recipe, with similar rheological characteristics to the waste form, passed all criteria for certification.

Certain physical properties were observed that concern HNUS. The final waste form exhibited fairly high porosity. Porosity appears to be a function of the rate of temperature rise during the curing process. The strength of the product decreased as porosity increased. In addition to strength loss, the higher porosity is believed to reduce the long term durability of the product. Durability tests of the product are currently ongoing and will be available within the next few weeks for evaluation. Since strength requirements and durability are not criterias for waste certification, we conclude that the full scale surrogate tests produced a certifiable product.

A list of engineered control systems are available to reduce the maximum temperature reached during the curing process and are identified in SECTION 6.0. HNUS recommends as a minimum pursuing the following:

1. Provide ventilation system in the curing tent to reduce ambient temperatures.

July 22, 1992

2. Continue study to reduce the effects of temperature rise during the curing process.

3. Consider the use of copper tubing in the pour to dissipate heat.

4. Include verification within the SO Test "hot test" of the conclusions of this temperature study.

Ventilation systems are envisioned to be required in the curing areas. From discussions with EG&G operational personnel, we understand that EG&G desires to transport the freshly cast halfcrate to the final storage area in one step. Typically one tent will be filled with freshly cast product. Based upon approximately 100 crates per day being produced on a double shift basis, Tents 2 thru 5 represent 10 days of storage capacity each. HNUS is concerned that the temperatures in the tent will be excessive for habitation of working personnel. We are prepared to provide EG&G an assessment of the engineering control systems available to remedy the problem. EG&G will need to establish some minimum criteria: maximum allowable temperature, stowage plan identifying aisle spaces and stacking plan, and limitations on ingress/egress through doorways on both ends of each tent.

HNUS will be examining the use of cement retarders in the process. Typically they retard the set rate of the product and reduce the maximum temperature rise during curing. Tests on actual waste show that the TCLP is not impacted with the introduction of retarders into the recipe. A testing program has been developed and is underway to optimize the benefits of retarders.

In addition, results obtained during full-scale testing have been incorporated into the design of the equipment train. The incoming temperature of the slurry to the RCM mixer was lowered by approximately 20 degrees by reducing the mechanical energy transferred into the slurry. This was accomplished by reconfiguring/reducing the speed of the incoming slurry pump and the pneumatic valve to the RCM. This also reduced the maximum temperature attained during curing by approximately 20 degrees. The results provided in the report present the data obtained after the equipment modifications.

Please advise what actions you may require after reviewing SECTION 6.0 – ONGOING/FUTURE WORK proposed.

If you have any questions or comments, please advise.

Sincerely,

HALLIBURTON NUS ENVIRONMENTAL CORPORATION

Ted Bittner

Ted A. Bittner
Project Manager

TAB/jg

cc: A. Allen
D. Brenneman
J. Childs
H. Harvey
S. Mathew
R. Ninesteel
R. Rodrigue
J. Zak

A:\LTR\FERRIER-107
RF-HED-92-0442

TABLE OF CONTENTS (Cont'd)

ATTACHMENTS

HALLIBURTON NUS
Environmental Corporation

WBS 235 TREATABILITY STUDY REPORT AND PROCESS FORMULATION REPORT FOR POND 207C AND CLARIFIER

APPENDIX H

TEMPERATURE RISE DURING CURING OF CEMENTED 207C AND CLARIFIER WASTE AND ITS EFFECTS

SHAJ A. MATHEW, Ph. D.
HALLIBURTON NUS ENVIRONMENTAL CORPORATION

JULY 1992

w/NU

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Pond 207C and Clarifier waste forms will be mixed with pozzolans to produce a solidified waste form. Concerns about the temperature rise during the curing phase resulted in a series of studies which examined the temperature rise and its effect on the final product. These included small and large scale testing on a surrogate material that had the same rheological properties as the waste.

The studies show that the temperature rise during curing did not cause any adverse effects on the criteria for certification of the final product. However the increased temperature caused an increase in the porosity and thereby a decrease in the strength of the product. The studies show that the effects of temperature rise can be reduced by increasing the thermal conductivity of the matrix. This results in a stronger product by producing a denser, less porous material.

In addition to the temperature-induced porosity, another concern is the effect that elevated temperatures may have on the long-term durability of the product. Tests currently underway are expected to provide some information about this.

Within the scope of the current process requirements, no adjustments to the process design are required to counter the temperature rise during curing, to generate a product that will meet the certification criteria. However, because of the concerns regarding porosity and long-term durability, some options are still being considered to reduce the temperature rise during curing.

The full-scale tests conducted in the course of the studies also yielded information on the operational viability of the mixing and conveying equipment that will be used for actual processing. The tests also provided information on the time window available for transportation of the freshly cast material.

1.0 PURPOSE

The rise in temperature during the curing phase of Pond 207C and Clarifier processing is the subject of this document. This phenomenon and its effects were examined in a series of studies which were conducted at the Halliburton Services Research Center in Duncan, Oklahoma. The study's main objectives using surrogate waste and full scale conditions were to:

- Determine the impact of curing temperatures on the quality of the product
- Correlate the conclusions from this study to the real waste and
- Identify any future action required.

In addition, the studies were also designed to:

- Measure temperature rise versus time in order to establish material handling qualifications for transporting freshly cast material
- Observe full scale operations of a surrogate waste which has similar rheological properties to the real waste and
- Observe the structural stability of the half crate during the casting of a liquid slurry.

2.0 BACKGROUND

The stabilization of Pond 207C and Clarifier requires the mixing of the slurried waste with a pozzolan mix consisting of Type V cement, Class C flyash and hydrated lime at a water to pozzolan ratio of 0.42. The cement, flyash, and lime would be pre-mixed at a ratio of 1:2:0.075. Hydrated lime is included in the mixture to stabilize the metal ions in the cement matrix by providing an alkaline medium.The cemented waste form will be poured into a rectangular box called a half-crate for curing, storage, and eventual disposal. This document deals with the anticipated internal temperature rise in the half-crate during the hydration phase of the pozzolans.

The hydration of pozzolanic materials involves a set of complex exothermic reactions. If the heat evolving from the hydration reaction is not allowed to escape (i.e. if adiabatic conditions exist), the temperature rise can be quite substantial [1]. In large monoliths (like the half-crate), true adiabatic conditions exist when the volume of the concrete far exceeds the surface area available for heat dissipation to the surroundings. The internal temperature rise under such conditions occurs predominantly during the first phase of hydration [2].

The generation of temperature rises in large bodies have led to concerns about cracking caused by 'thermo-stresses' due to differences in temperature between the interior and surface and 'boiling-off' of the water phase [3]. Similar concerns exist for the Pond 207C/Clarifier processing, including the impact of temperature rise on the production of a certifiable product.

Several options exist to moderate the temperature rise, including increasing the thermal conductivity of the matrix and the addition of inert additives or aggregates [4]. Potential aggregates that can be added to the matrix include inert solids like the suspended solids already present in the waste or clean sand that can act as a filler. In the pozzolan mixture used for Pond 207C/Clarifier processing, the amount of Class C Flyash is twice the amount of Type V cement. In addition to having a much lower heat of hydration compared to cement, flyash has the effect of retarding the hydration of cement and thus lowering the heat of hydration even further. In addition, it has been shown that even mixes with a high percentage of flyash maintain their structural integrity [4]. The presence of large amounts of inorganic salts found in the

207C pond will hasten the hydration reaction and lead to a larger temperature rise.

To examine the effects that the increased temperature of the cemented waste form would have on the certification parameters, a series of tests were conducted with surrogate wastes at Halliburton Services facilities in Duncan, Oklahoma in May-June 1992. The surrogate waste was developed to simulate the rheological characteristics of the mixture of pozzolans and the Pond 207C/Clarifier waste form.

The preliminary tests were conducted on a small scale during which the cemented surrogate was treated to high temperatures externally. This was followed with large scale testing where the surrogate waste was mixed up with the pozzolans in the RCM and poured into half-crates to simulate the conditions existing during processing and casting a monolith similar in size to the final product.

It would be pertinent at this stage to define some of the terms used throughout this document. The '% water' in a slurry is the % of available water by mass in the 207C/Clarifier slurry after subtracting the contributions of dissolved salts and suspended solids to the total mass. The pozzolans are added to the slurry on a mass basis at a fixed 'water to pozzolan ratio'. 'Pozzolans' are defined as the combined blend of cement, flyash, and lime.

3.0 PRELIMINARY TESTING

The preliminary testing conducted at the Halliburton Services Research Center was geared to mimic the effect of the high temperature attained inside a large monolith on a miniature scale to examine the hydration profile of the cemented waste form under high temperatures. External heat had to be applied to these samples since small samples would never attain the adiabatic conditions existing in the core of a half crete. For this purpose a surrogate of the Pond 207C/Clarifier waste form was mixed with pozzolans in the appropriate ratio (water/pozzolans=0.42) and the mixture was subjected to curing at a range of temperatures. The cooled samples were subjected to X-ray diffraction and Unconfined Compressive Strength (UCS) testing to examine the effects that temperature may have had on their properties.

3.1 Experimental

A surrogate had to be prepared in lieu of the actual Pond 207C/Clarifier waste because of the radioactive nature of the real waste form. The Research Center is not licensed to accept radioactive material. The salt composition used in the surrogate (Table I) is representative of the 374 Brine at Rocky Flats. A 31% by weight solution was made up with water to make the surrogate waste. The brine solution was mixed with pozzolans, such that the water to pozzolan ratio was 0.42. The pozzolans were made up of 1 parts Type V cement, 2 parts Class C fly ash, and 0.075 parts of hydrated lime.

TABLE I
COMPOSITION OF SALT MIXTURE IN SURROGATE

SALT	WEIGHT %
Sodium Nitrate	44.3
Potassium Nitrate	27.7
Sodium Chloride	7.8
Potassium Chloride	1.8
Sodium Sulfate	4.5
Potassium Sulfate	1.4
Sodium Phosphate	0.8
Potassium Phosphate	0.4
Sodium Carbonate	6.8
Calcium Hydroxide	4.5

The brine and the pozzolans were mixed in a Waring blender and cured at 150, 200, 250, 300 and 350^{0}F for two days under 3000 psi pressure. The pressure was necessary to prevent the water in the system from boiling off since the boiling point of water is 212^{0}F. [The impact that the dissolved salts has had in elevating the boiling point of the water has been minimal; approximately 213^{0}F at 500 feet above Mean Sea Level (MSL). The boiling point of the brine could be expected to be lower in Denver due to its altitude - 5400 feet above MSL.] The curing methodology used was similar to the 48-hour accelerated cures done during treatability testing at Halliburton NUS laboratories in Pittsburgh. The heated samples were allowed to cool to room temperature. After two days of curing, the samples were subjected to UCS testing and X-ray diffraction analysis.

3.2 Results/Discussion

The UCS tests were conducted to ascertain the effect that the temperatures would have on the strength of the samples. The UCS results of the samples at different temperatures are shown in Table II.

TABLE II
COMPRESSIVE STRENGTHS OF SAMPLES AFTER 48 HOUR CURES AT DIFFERENT TEMPERATURES

CURING TEMPERATURE °F	COMPRESSIVE STRENGTH (psi)
150	1345
200	1243
250	908
300	1209
350	1077

Although there seems to be a decline in strength with increasing temperatures, the overall strength of the matrices are within a range that would be considered normal. The UCS data indicate a fairly typical hydration profile with no observable detrimental effects of high temperature on hydration.

The X-ray diffraction study was conducted to examine the effect that temperature has on the hydration products during the critical initial phase. The X-ray diffraction patterns for the samples at different temperatures are shown in Figures 1-5. The figures show the diffraction peaks caused by the different crystal faces associated with the various crystalline components in the matrix. The consolidated results are tabulated in Table III.

TABLE III
CONSOLIDATED SUMMARY OF X-RAY DIFFRACTION ANALYSES OF SAMPLES AT DIFFERENT TEMPERATURES

COMPONENT	AMOUNT AT 150°F	AMOUNT AT 200°F	AMOUNT AT 250°F	AMOUNT AT 300°F	AMOUNT AT 350°F
Unhydrated Cement	moderate	moderate	moderate	small	small
Tobermorite	--	very small	small	moderate	moderate
Hydrogarnet	very small	small	small	small	small
Quartz	very small	very small	trace	trace	--
Calcite	--	--	--	trace	small
$C_3(OH)_2$	small	--	--	--	--
$C_{24}Al_2O_6.10H_2O$	small	--	--	--	--

The peaks in the X-ray diffraction patterns of the samples at different temperatures show higher concentrations of the tobermorite crystalline phase at higher temperatures. Tobermorite is one of the phases that is produced at higher temperatures. Since it is a stable phase, this should have no adverse impact on product stability. Unhydrated cement could be observed in greater amounts at the lower temperatures. The amount of unhydrated materials decreased as the curing temperature increased. Given sufficient time, these unhydrated materials would have undergone nearly complete hydration. In total, the X-ray diffraction analyses do not show any significant aberrations from the norm even at elevated temperatures.

It can be concluded from these laboratory studies that within the temperature range of 150^0F to 350^0F, the hydration profiles of the pozzolans were normal and that temperature had minimal effect on the hydration profile and thus the structural integrity of the cemented waste form.

4.0 FULL SCALE TESTING

The positive results from preliminary testing had shown that externally applied heat up to a temperature of 350°F had no adverse effects on the setting of the pozzolan waste mixture.

To verify whether the same phenomenon occurred with the internal heat produced in the half crate, a series of large scale tests were conducted. In addition, the purpose of these tests was also to ascertain whether the internal heat generated in the half crate during cement hydration had any effect on the certification parameters. The relevant parameters for certification include TCLP, test for free liquids, DOT Solids Test, and test for particulates.

A total of eleven halfcrates were cast (including the few discussed in this report) during the course of the full-scale testing held at Halliburton facilities in Duncan, Oklahoma. During the course of this testing, a field demonstration was witnessed by representatives of EG&G and the Department of Energy on May 28, 1992. At the demonstration test, the surrogate recipe was mixed using the equipment built specifically for this project and the material was cast into the bladder within the half crate boxes.

4.1 Experimental/Results

To create a surrogate for these tests, water was mixed with the salt mixture (shown in Table I) to produce a 31.4 % by weight salt solution. This salt solution was then blended with the pre-mixed pozzolan mixture at the appropriate water to pozzolan ratio in a 8 bbl. RCM. The thoroughly mixed slurry was poured into plastic lined half-crates. Most of the slurry was cast into bladders to replicate the proposed casting method.

Tests were not conducted on recipes that contained suspended solids since the inert solids would tend to lower the maximum temperature by increasing the thermal conductivity of the matrix. During waste processing, the suspended solids will vary between 0 and 11%.

For each of these tests, thermocouples were placed at critical points in the half-crate. The thermocouples used were certified by the supplier to be accurate within ± 1^{0}F over the range that was tested. The half-crate was then sealed and the top wooden lid put in its place.

Temperatures were recorded every fifteen minutes during the initial heat rise and then every hour for the next several days. The half crate was then dismantled and the packaging removed. Visual inspections were performed for free water on the surface of the product or trapped within the packaging. No free water or excessive particulates were observed in any of the half crate containers that were cast in Duncan. 6-inch cores were taken from the center of the half-crate for further examination. Smaller cores were made from the 6-inch core to examine the structural integrity of the top, center and bottom of the 6-inch core by means of UCS testing.

These cores were also subjected to TCLP leach tests. The pHs of the TCLP leachate were examined. The pH of the TCLP leachate is an indirect indication of the metal ion concentration in it. It has been shown in the treatability study report [5] that when the pH of the TCLP leachate is between 10.4 and 12.2, the concentrations of the restricted metal ions were below the permissible limits.

<u>Test 1</u> <u>Conducted at water to pozzolan ratio of 0.42</u>

The first full-scale test was conducted at the water to pozzolan ratio at which the job would be performed at Rocky Flats (i.e., at a water to pozzolan ratio of 0.42).

The temperature measured at the center of the half-crate as a function of time is shown in Figure 6. As can be seen from Figure 6, the temperature at the center of the half-crate reached a maximum of 217.5°F about 21 hours after the slurry was poured into the box. After reaching a maximum, the center of the half-crate gradually underwent cooling over several days. A photograph of the core obtained from the center of the half-crate is shown in Figure 7. This core was recorded and the miniature 1-inch cores obtained from it were subjected to strength and TCLP testing, the results of which are summarized in Table IV.

TABLE IV
SUMMARY OF CENTER CORE DATA FROM HALF CRATE AT W/P=0.42

WATER TO POZZOLAN RATIO	POSITION IN HALF CRATE	HIGHEST TEMP. (time taken to attain it)	UCS (psi)	pH of TCLP LEACHATE
0.42	TOP	--	660	11.2
0.42	CENTER	217.5^{0}F (21 HRS)	423	11.1
0.42	BOTTOM	--	560	10.9

The data in Table IV most significantly shows that the temperature rise did not have any adverse impact on the pH of the TCLP leachate. This is because the alkalinity of the matrix would be unaffected by the temperature. In addition, the UCS data showed that the material had a substantial level of strength. Even at the center of the half-crate which would have experienced the highest temperature rise, the UCS test data showed a considerable amount of strength. However, the strength of the material in the center of the half crate (which would have experienced the greatest temperature rise) is lesser than at the top or the bottom.

The core shown in Figure 7 shows a substantial number of voids forced by steam resulting from high temperatures inside the half crate. However, the fairly homogenous distribution of voids throughout the matrix shows that the uneven temperature distribution in the half crate had no effect on porosity distribution.

Petrographic examination of the core confirmed the uniform porosity distribution in the matrix. The studies also showed that crystal growth and micro-cracking were almost non-existent. In addition, no settling or segregation of the cement grains were observed. The studies confirmed an earlier observation that the core appeared to be very homogeneous from the top to the bottom.

The solidified half crate did not have any observable free moisture and did not have any significant amount of fine particulates. There was slight map-cracking observable on the surface but this did not extend to more than one inch below the surface. The product would have thus passed the test for free liquids, the DOT solids test and the test for fine particulates. As can be inferred from the pH of the TCLP leachate, it would also pass the metal ion concentration allowed by the LDR requirements.

To summarize, the data from a regular half-crate produced using a water to pozzolan ratio of 0.42 shows that the temperature rise observed in the test had no adverse impact on either the strength of the matrix or the parameters for certification.

<u>Test 2</u> <u>Conducted at a water to Pozzolan Ratio of 0.42 with Copper Tubes for greater thermal conductivity</u>

Since concrete does not conduct heat readily, Test 1 was repeated with copper tubes placed inside the half-crate. The positioning of the copper tubes is shown in Figure 8. The idea was to improve the thermal conductivity in the monolith in a relatively simple manner. The hollow copper tubes were 3" in diameter and had sealed bottoms and open tops. Liquid slurry was not allowed to fill the annulus of the pipe.

The temperature at the center of this half-crate is shown in Figure 9. Temperatures and corresponding hours were also measured at various other positions of the half-crate and is shown in Figure 10. 'Center' in the figure designates the geometric center of the solidified waste form, 'Top' designates the geometric center of the top surface of the monolith, 'Bottom' designates the geometric center of the bottom surface of the monolith, and 'End' is the geometric center of the smallest rectangular face of the monolith.

A photograph of a core obtained from the center of the half-crate is shown in Figure 11. Compared to that from Test 1, without copper tubes, the core in Test 2 shows far fewer voids.

The temperature at the center of the half-crate reached a maximum of 224°F after 10 hours. This along with the data from the other tests is tabulated in Table V.

TABLE V
SUMMARY OF CENTER CORE DATA FROM HALF CRATE AT W/P=0.42 WITH DIAGONALLY PLACED COPPER TUBES

WATER TO POZZOLAN RATIO	POSITION IN HALF CRATE	HIGHEST TEMP. (time taken to attain it)	UCS (psi)	pH of TCLP LEACHATE
0.42	TOP	220^{0}F (10 HRS)	990	11.1
0.42	CENTER	224^{0}F (10 HRS)	--	--
0.42	BOTTOM	222^{0}F (11 HRS)	1113	11.2

As the temperature data shows, the copper tubes enable an even distribution of heat throughout the concrete matrix by removing heat from the center of the core (which is the hottest) and distributing it to the surfaces (where it is the coolest). As expected, the pHs of the TCLP leachate were unaffected by the high temperature or the temperature differential between the center and the surface. In addition, as in the previous test, there was no observable free water or particulates in the solidified waste form.

However, the strength (as indicated by UCS results) almost doubled. This is likely due to the far fewer voids in the core as seen in Figure 11. The copper tubes and the uniform heat distribution that they provided seems to have helped achieve this higher strength.

Test 3 Conducted at a water to pozzolan ratio of 0.48 (no copper tubes)

The third test was conducted at a higher water to pozzolan ratio of 0.48. This results in a decreased amount of Pozzolan (lower by approximately 13%) leading to a lower net heat release. The temperature changes with time are shown in Figures 12 and 13. The photograph of the core from the center of the half crate is shown in Figure 14. The picture shows a fairly uniform core with even fewer voids than that in Test 2. The test data are summarized in Table VI.

TABLE VI
SUMMARY OF CENTER CORE DATA FROM HALF CRATE AT W/P=0.48

WATER TO POZZOLAN RATIO	POSITION IN HALF CRATE	HIGHEST TEMP. (time taken to attain it)	UCS (psi)	pH of TCLP LEACHATE
0.48	TOP	180^0F (14 HRS)	1520	11.1
0.48	CENTER	226^0F (14 HRS)	1047	11.0
0.48	BOTTOM	208^0F (14 HRS)	1227	11.1

The maximum temperature at the center of the half crate made at a water to pozzolan ratio of 0.48 is not much different from that conducted at a water to pozzolan ratio of 0.42 with copper tubes for better conductivity. When compared to the test with the copper tubes placed in the matrix, this test, with a higher water content, shows a greater temperature differential between the interior and the exterior of the monolith.

However, the additional water content did not adversely impact the porosity of the matrix. In fact, the strength of the material in this test is even higher than that in Test 2. Fewer voids were produced which provided a more homogeneous core. Also, the pH of the TCLP leachate was within the range that was acceptable to project criteria.

<u>Tests 4 & 5</u> <u>Conducted with different crate lengths</u>

Another set of tests were performed to examine the contribution of the shape of the half-crate to the temperature rise in the center of it. For this purpose, two boxes of different shapes - Irregular Shape A (48 in. x 28 in. x 24 in.) and Irregular Shape B (48 in. x 48 in. x 24 in.) were constructed (Figure 15) and the cement slurry at a water to pozzolan ratio of 0.42 was poured into it. The maximum temperature at the center of the half-crate was 246°F and 260°F respectively. This is a higher temperature rise than what was observed with the half-crate. The condition that seems to affect the maximum temperature gain is the relationship of mass to surface area. The results show that increasing the surface area per unit mass of the monolith did not decrease the net temperature gain during curing.

Consequently, regardless of the configuration of the container, the only reasonable method to reduce the temperature rise during curing may be to reduce the thickness of the pour.

4.2 Discussion

4.2.1 Temperature and Product Strength

The temperature data from the first three tests is summarized in Figure 16 and presents the half crate center temperatures for the three tests as a function of time.

As indicated, the crate with the copper tubes (Test 2) and the crate with the higher water content (Test 3) reached their maximum temperatures faster than the crate with the water to pozzolan ratio of 0.42 (Test 1), which is the nominal water to pozzolan ratio for processing. This implies that for Tests 2 and 3, there was a faster rate of cement hydration than for Test 1. The accelerated hydration reaction in turn created a greater temperature rise which then caused an even faster rate of cement hydration; in effect creating a closed loop, thus accounting for the results observed.

In Test 2 the copper tubes enabled a greater degree of heat transfer to the peripheries of the matrix from its center and accelerated the hydration reaction in those areas which in turn transmitted more heat to the adjoining areas leading to the faster temperature rise. The reason for the increased temperature rise in Test 3 is not clearly understood. It could be attributed to the greater availability of water to the cement for the reaction. The heat generated in turn accelerates the reaction even further.

In the cases of both Tests 2 and 3, the faster temperature rise leads to a faster curing (and setting) of the pozzolans. After the gel lattice undergoes setting, it becomes more difficult for the hot steam to create the voids that cause matrix porosity. Voids are much more likely to be formed in an unset cement mass, than within a gelled lattice structure. This is borne out by the strength data which show that the strength attained by the half crate in Test 1 was lower than that achieved in Tests 2 and 3. The greater porosity produced by Test 1 than Tests 2 or 3 can be observed in Figures 7, 11, and 13. It has to be noted however, that the maximum temperatures attained by Tests 1, 2 and 3 are approximately the same.

A similar outcome could also be caused by inducing the entirely opposite effect on the hydration reaction by slowing it down with the use of retarders. This would so reduce the reaction rate and would flatten the temperature-time curve such that high temperatures might not be encountered. This however needs to be verified by further testing.

4.2.2 Setting Times of Cast Product

The hydration process undergoes a primary stage (also called the preinduction stage) during which there is slight heat evolution followed by a second stage (the induction stage) during which the mix is relatively dormant [6]. Figure 17 displays the first few hours after casting shown in Figure 16 on a larger scale. This illustrates that the first two stages cannot be distinguished very clearly from each other, probably because of the size of the monolith and its insulating properties. The shape of the curve is similar to what has been reported elsewhere in another technical publication [7]. It is after the induction period that the gel lattice structure starts formation accompanied by active cement hydration and a rapid temperature rise. This gel formation will be damaged by vibration or any other vigorous movement. Once this phase commences, the crystalline formations are very weak and if disrupted may not be capable of rebonding during the curing process. The data in Figure 17 show that the third stage does not start until after four hours. A conservative estimate for the window available for physical handling of the half crate before it should be set aside for curing, is about two hours. Data obtained during treatability testing show that after forty eight hours of curing, the product had gained a sufficient degree of strength to allow transporting the product without detrimental effects to the waste form.

Tests reported earlier showed that the cemented 207C Pond material becomes a DOT solid in approximately twelve hours and the the cemented Pond 207C/Clarifier becomes a DOT solid after four hours as defined by the DOT Paint Can test [8]. Thus it can be concluded that the material will be a liquid mass during the initial transportation from the casting to the curing station.

4.2.3 Relevance of Surrogate Tests

It should be emphasized that the aforementioned tests (and therefore its conclusions) were conducted on a surrogate which was chosen for its rheological similarity when mixed with the pozzolans. So, although these tests were not conducted on the actual waste form, it is reasonable that the results are fairly similar to what one may expect with the actual waste. This is because both the salt and cement loading used in the surrogate mix closely represent the 207C/Clarifier waste. In addition, many results of the surrogate testing match those observed with the real waste in the Halliburton NUS laboratories in Pittsburgh. These include:

- The pH of the TCLP leachate; both sets of data reflect that the pH is above that which would be required for acceptable metal ion concentrations.

- Strengths of the final product made from surrogate and real waste are similar.

- Similar results can be seen in the petrographic analyses.

4.2.4 Anticipated Site Conditions

It has to be noted that the surrogate tests were conducted under warmer temperature conditions (during May-June in Oklahoma) than will be experienced during the Fall at Rocky Flats. Thus the incoming temperature can be expected to be much lower during actual operations. In addition, the presence of suspended solids in the actual waste should lower the temperature rise in the half crate.

4.2.5 Half Crate Strength Test

Another purpose of this testing program was to evaluate the structural integrity of the half crate. Waste certification requirements allow a maximum deflection, during closure, of 3/8-inch in any direction.

Deflections along the top edge of the sides were 1/2-inch along the 7-foot dimension and 7/16-inch along the 4-foot dimension. The surrogate waste was poured to a height of 19-inches within the box prior to sealing. No deflection was observed along the sides once the top was secured. Neither was any bulging or expansion observed during the curing process of the waste. The half crate container weighs about 380 lbs. The half crate filled with the cemented waste (at a density of 117 lbs/cu. ft.) would weighed a total of 4475 lbs.

From this study, it was concluded that a temporary bracing system is required to support the half crate prior to securing the lid. Once the lid is installed, the temporary bracing system can be removed. EG&G is currently tasked with designing the bracing system.

5.0 CONCLUSIONS

The operating parameters for the processing of Pond 207C and Clarifier are defined in the Treatability Study Report [5]. These parameters identified in the laboratory produced a product that passes all certification requirements as defined in NVO-325 (October 1988). The various operating parameters were tested in a full scale demonstration using a surrogate waste. Control experiments were established to verify that the surrogate waste had similar rheological and physical properties.

The following conclusions can be drawn from the study of the impact of large temperature rises in the solidified Pond 207C and Clarifier waste form on its properties:

- **Impact on Certification Parameters**
  Any temperature gains experienced during curing of the half crates did not negatively impact the certification requirements including -

  1. TCLP concentrations for compliance with LDR requirements (as inferred from the pH of the TCLP leachate remaining between 10.4 and 12.2).

  2. Paint Can Test (for certification as DOT solid).

  3. Paint Filter Test (for certification of the absence of free liquids)

  4. Criteria for Fine Particulates

- **Impact on Hydration Profile**

  The X-ray diffraction data on the surrogate waste-pozzolan mixtures cured at temperatures similar to those experienced in the half-crates showed that the elevated temperatures had minimal effect on the hydration profile of the cement.

- **Impact on Porosity**

  The tests show that the temperature rise in the half crate with a water to pozzolan ratio of 0.42, does introduce a certain amount of homogenous porosity into the matrix. Porosity may be a function of temperature gain versus time in that the faster the temperature gain, the lesser the porosity. The lesser the porosity in the matrix, the greater the strength of the product.

The porosity introduced by the high temperatures could have adverse effects on the long term durability of the product. Tests are currently underway to examine this issue.

- **Impact on Compressive Strength**

  The strength of the solidified product is not a criterion for certification. However, it has been shown with the testing conducted that the strength of the material cured at elevated temperatures was lower from those cured at lower temperatures (during treatability testing). The strength increased both when the thermal conductivity of the matrix was improved and when the water content in the matrix was increased.

The other conclusions that can be drawn from this study are:

- **Transportation of Freshly Cast Material**

  It has been shown that the freshly cast material can be moved around for two hours before it has to be kept static for a period of about forty eight hours.

- **Full Scale Operations**

  The tests on the surrogate material showed that the process can be conducted on a large scale using the mixing and conveying equipment that were specified in the design.

6.0 ONGOING/FUTURE WORK

Although there are no significant adverse effects related product certification due to the temperature rise during the curing of the half crate, concerns still exist about the impact of temperature on porosity, strength, and long term durability of the solidified waste form. Durability testing is currently underway on the products produced from the different tests mentioned in this document. In addition, various methodologies could be evaluated to counter the effect of temperature, including:

- **Retardation of Hydration**

  The use of chemicals which retard the hydration reaction will be evaluated. These would be blended into the pozzolan mix off-site or metered into the cementing operation. The study would include additional treatability testing to verify the certifiability of the final product.

- **Systems to Reduce Temperature**

  - Engineering modifications to minimize mechanical energy input into the system
  - Use of copper piping to dissipate heat inside the half crate containers
  - Chilling the slurry prior to cementing to reduce the incoming temperature
  - Providing ventilation systems in the curing tent to reduce ambient air temperature
  - Minimizing the allowable thickness of material cast in the half crate

Currently all the options excepting chilling the slurry and reducing half crate thickness are being evaluated. Those were considered impractical to implement at the facility.

Any subsequent recommendations and findings will be reported in a separate report.

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Figure 1

X-RAY DIFFRACTION PATTERN OF SURROGATE WASTE CURED AT 150°F

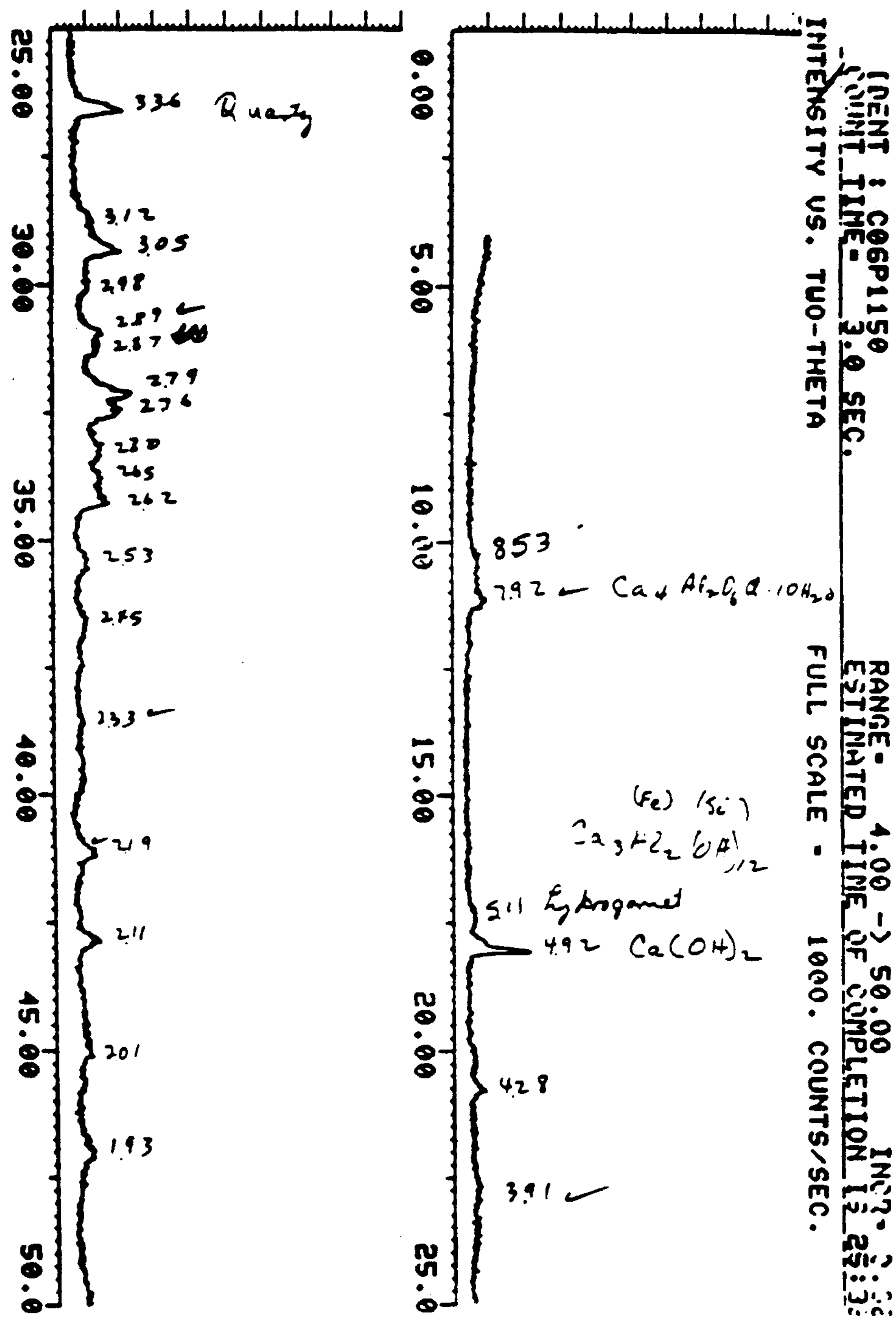

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Figure 2

X-RAY DIFFRACTION PATTERN OF SURROGATE WASTE CURED AT 200°F

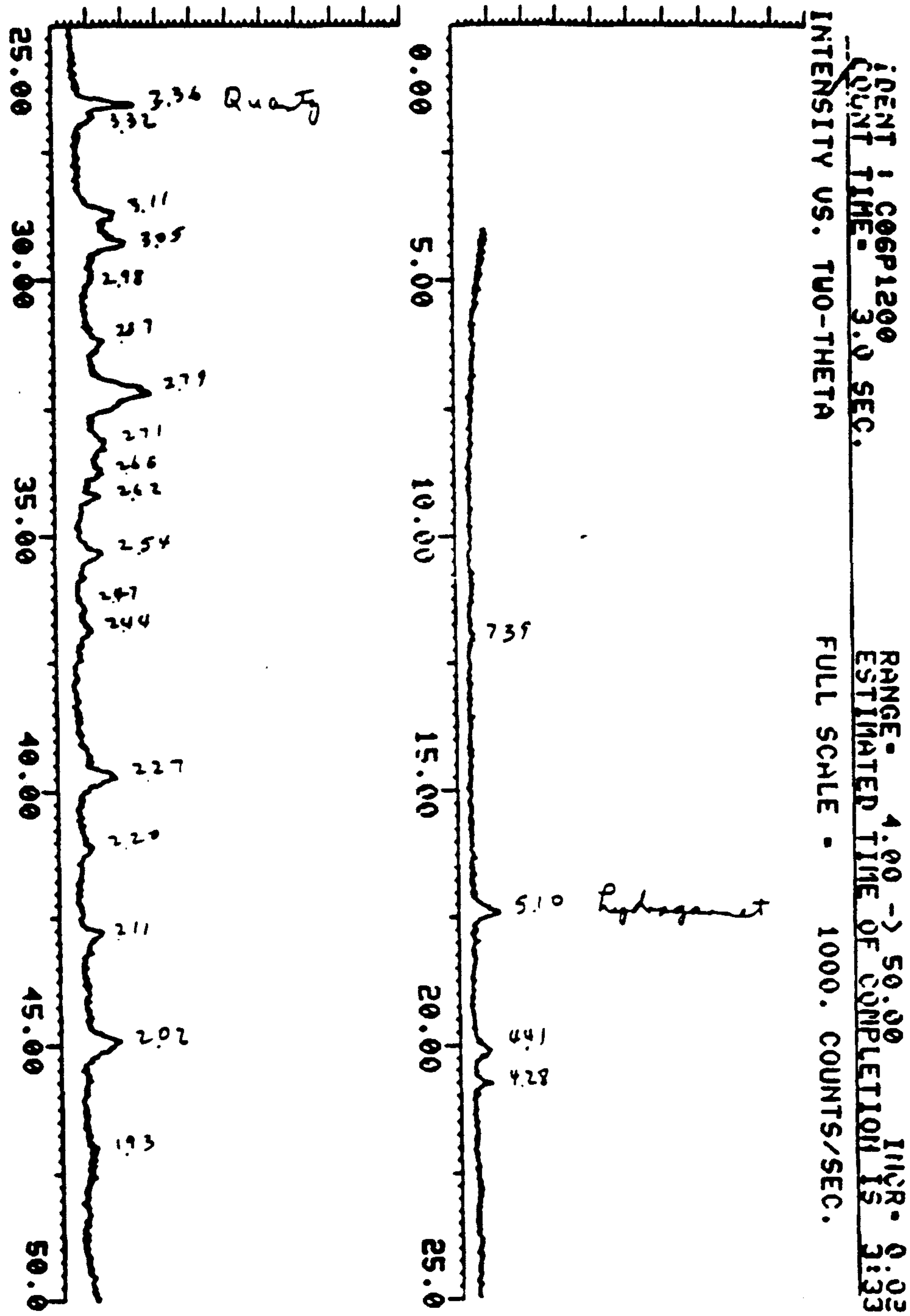

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Figure 3

X-RAY DIFFRACTION PATTERN OF SURROGATE WASTE CURED AT 250°F

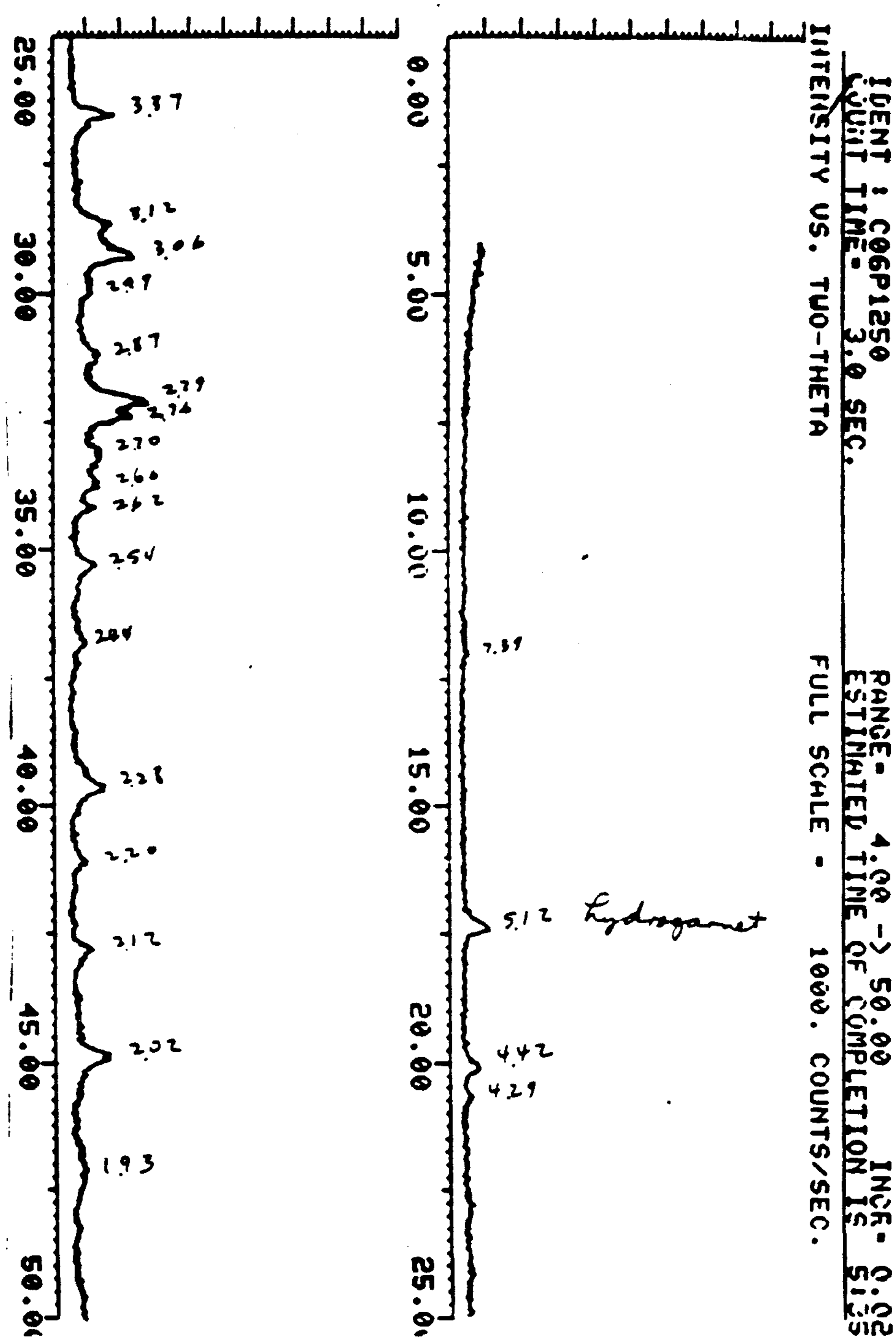

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Figure 4

X-RAY DIFFRACTION PATTERN OF SURROGATE WASTE CURED AT 300°F

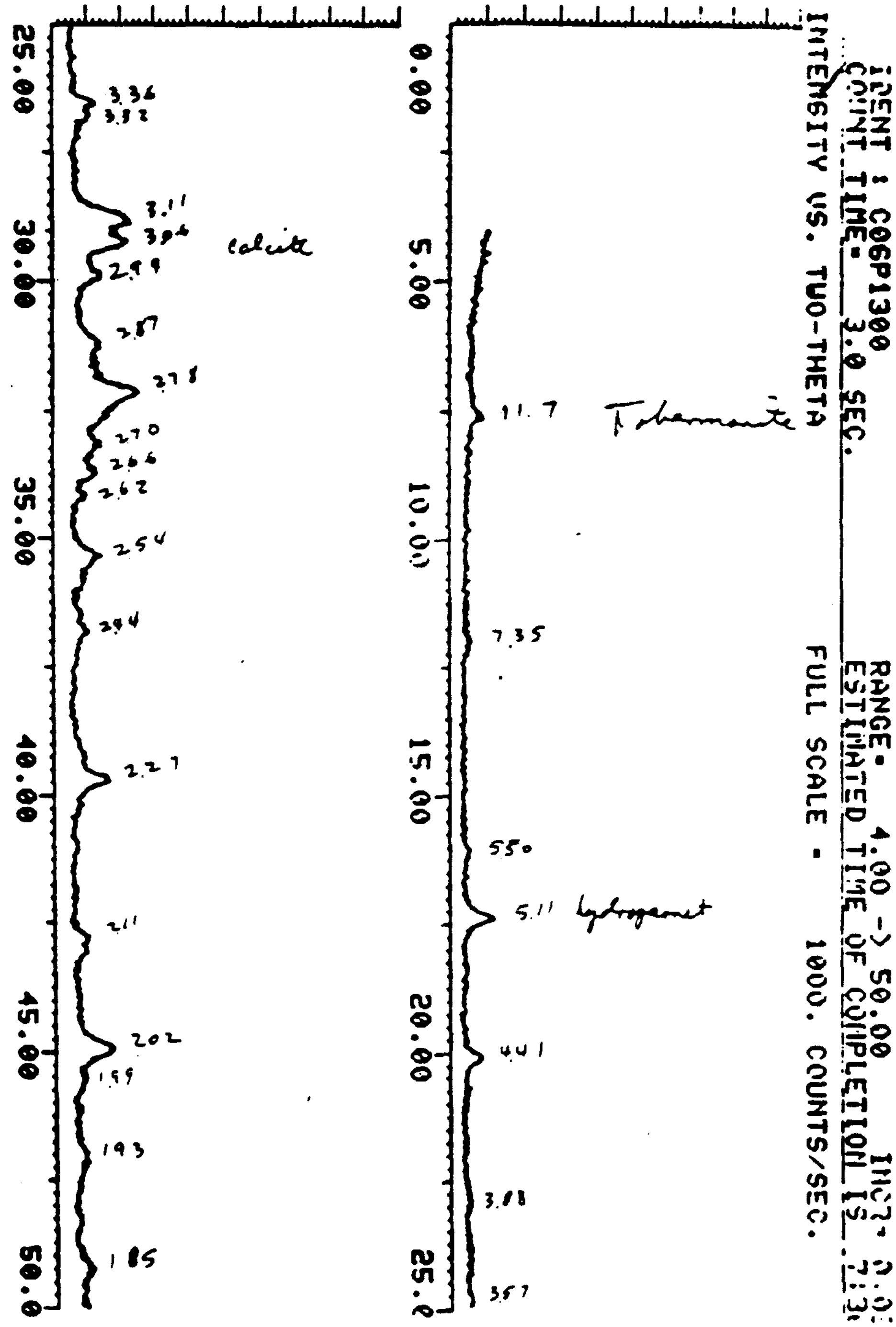

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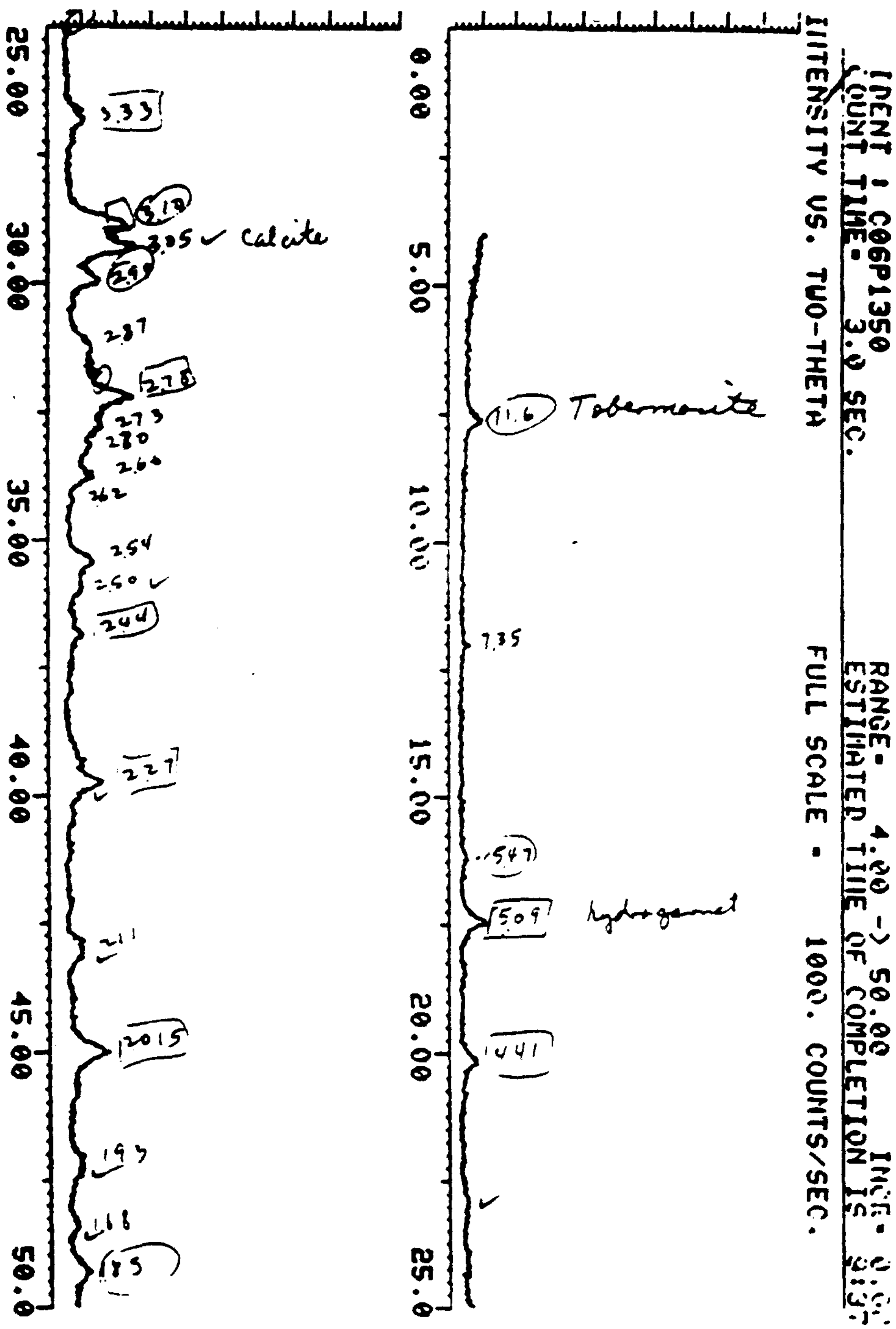
Figure 5

X-RAY DIFFRACTION PATTERN OF SURROGATE WASTE CURED AT 350°F



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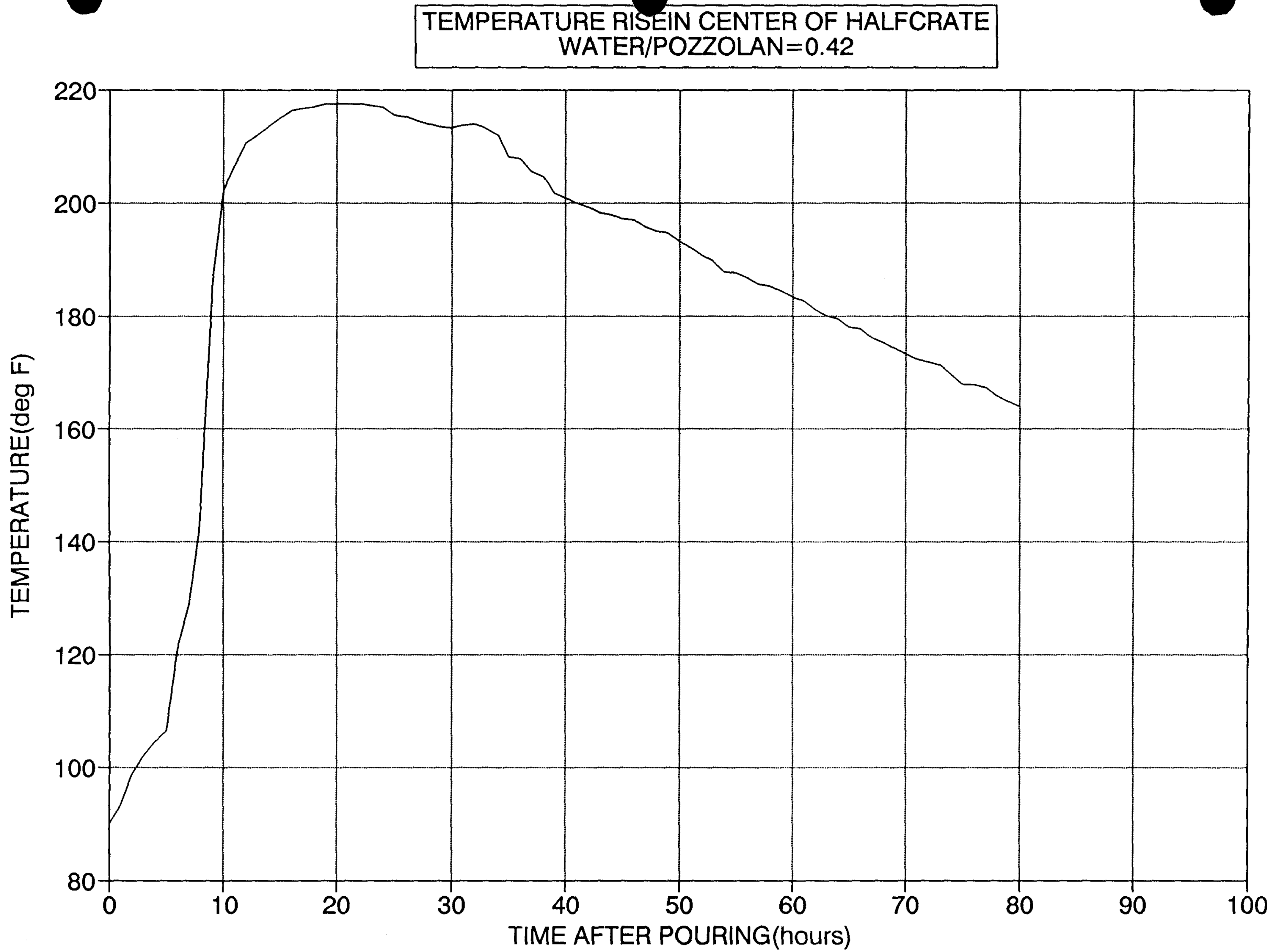
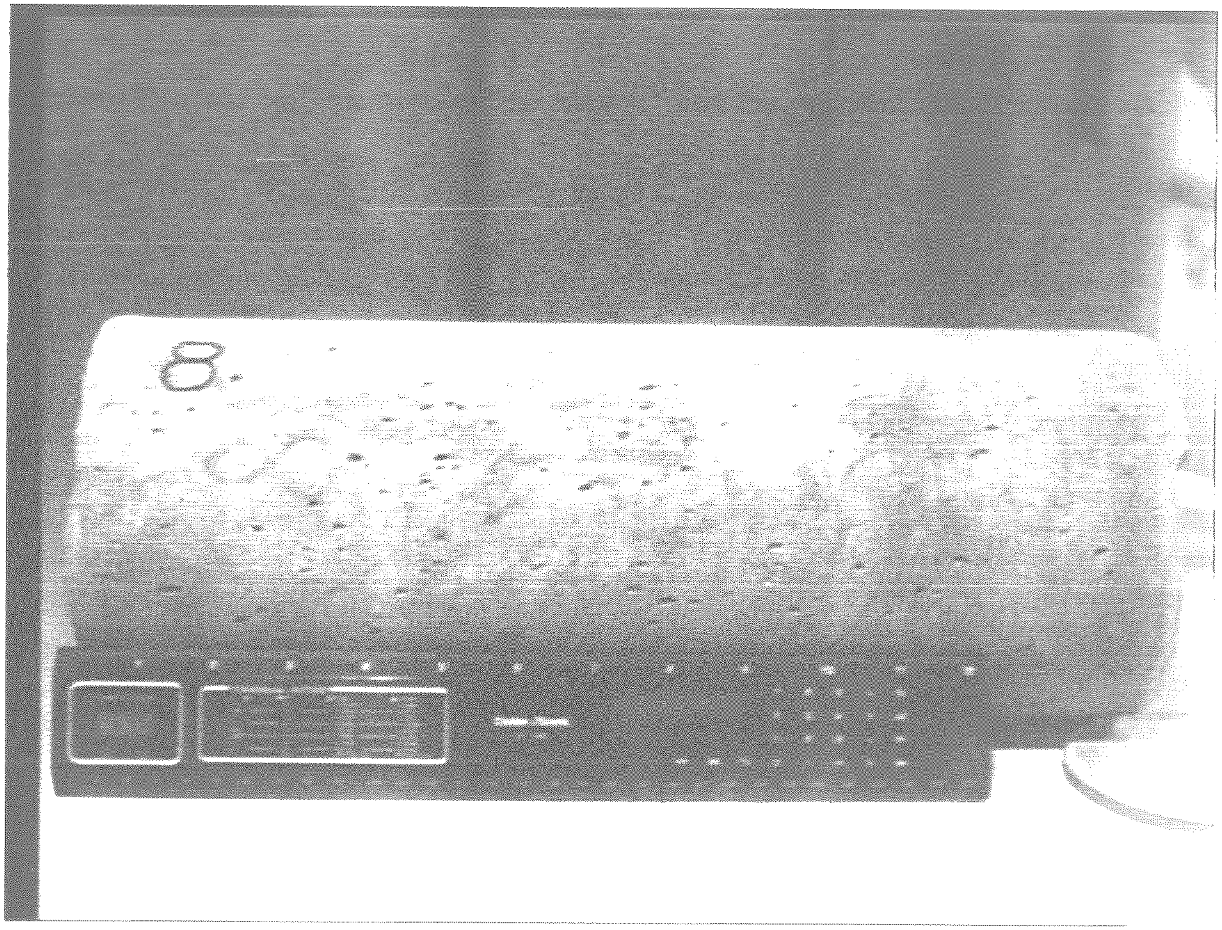

TEMPERATURE RISEIN CENTER OF HALFCRATE
WATER/POZZOLAN=0.42
220
200
180
160
140
120
100
80
TEMPERATURE(deg F)
0
10
20
30
40
50
60
70
80
90
100
TIME AFTER POURING(hours)

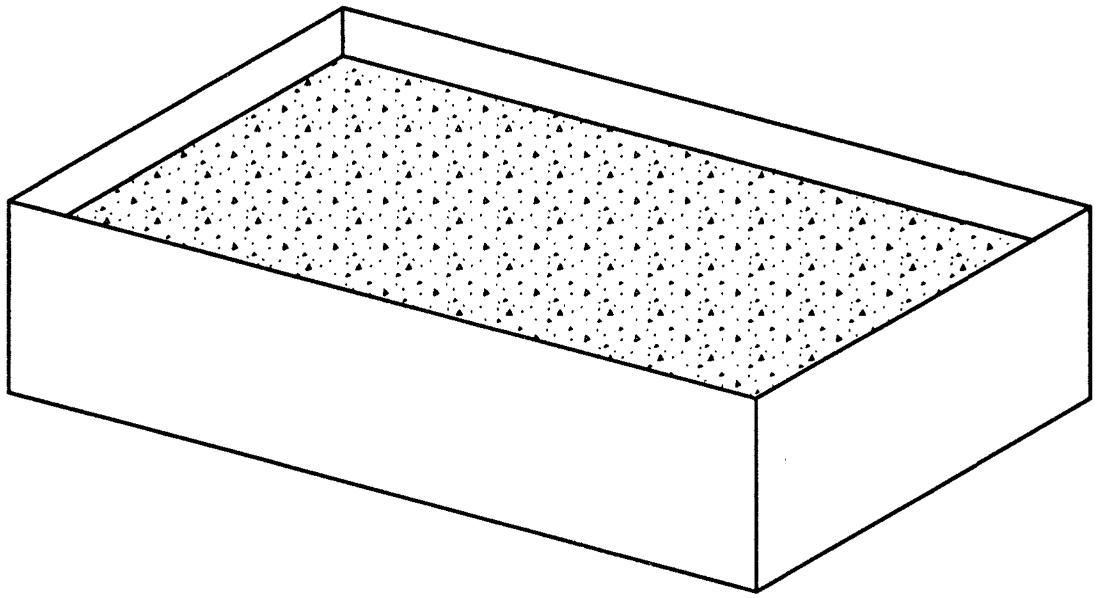
Figure 6

Figure 7



CORE FROM CENTER OF HALF CRATE
[WATER / POZZOLAN = 0.42]

HALF CRATE WITH CEMENT SLURRY



HALF CRATE WITH CEMENT SLURRY
WITH COPPER TUBES

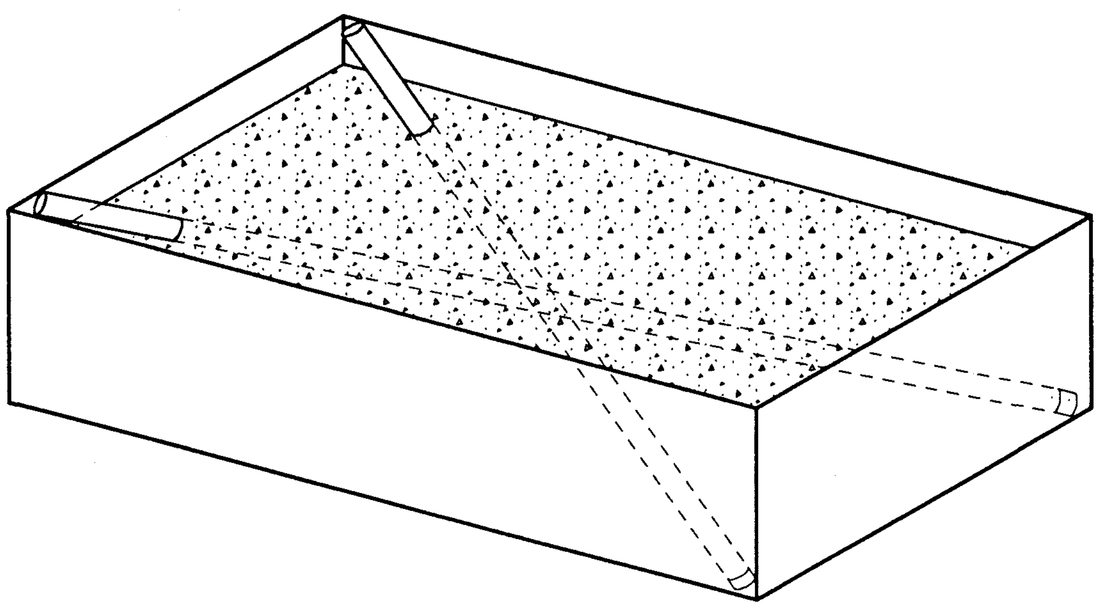


Figure 8

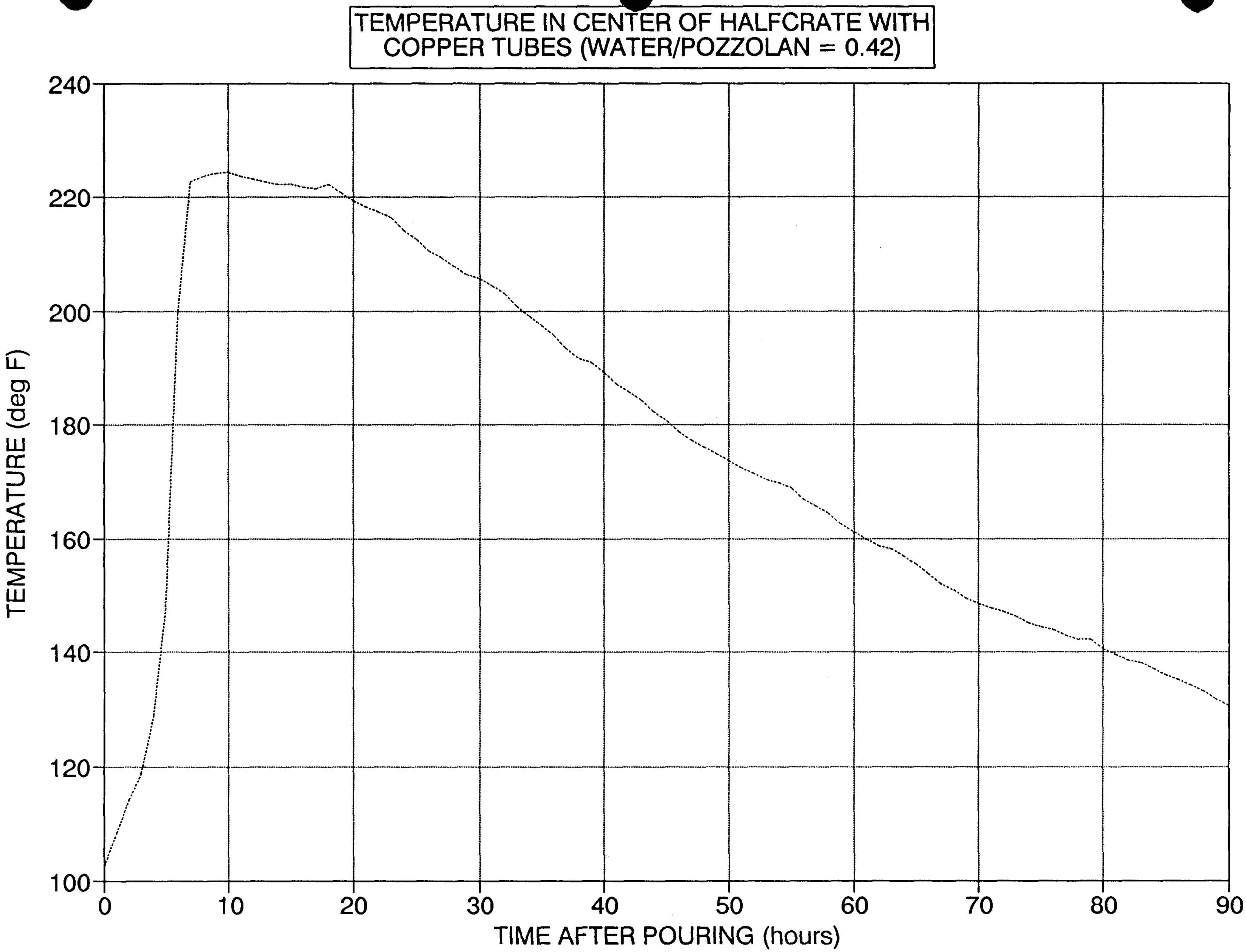

TEMPERATURE IN CENTER OF HALFCRATE WITH
COPPER TUBES (WATER/POZZOLAN = 0.42)
TEMPERATURE (deg F)
240
220
200
180
160
140
120
100
0
10
20
30
40
50
60
70
80
90
TIME AFTER POURING (hours)

Figure 9

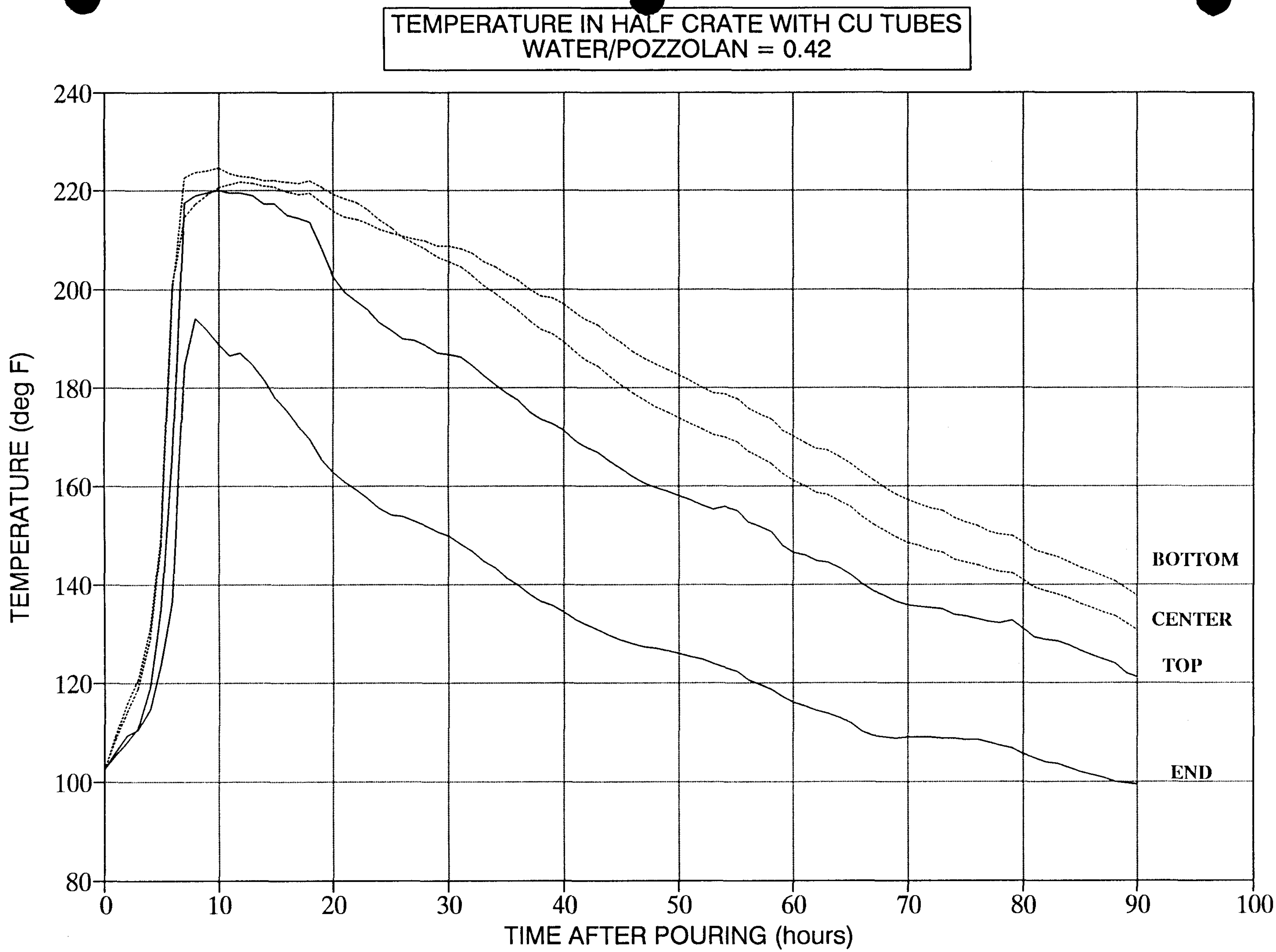
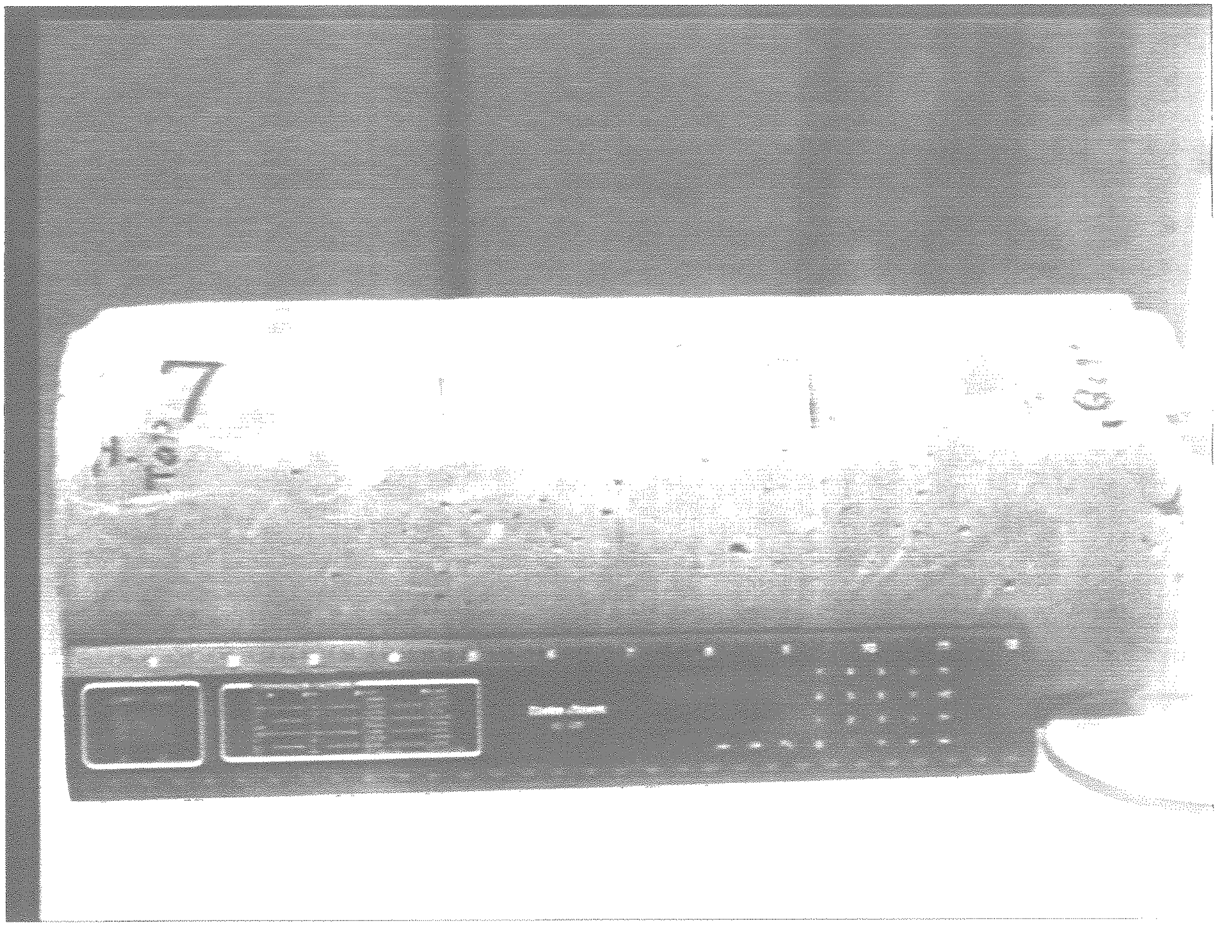

TEMPERATURE IN HALF CRATE WITH CU TUBES
WATER/POZZOLAN = 0.42
TEMPERATURE (deg F)
240
220
200
180
160
140
120
100
80
0
10
20
30
40
50
60
70
80
90
100
TIME AFTER POURING (hours)
BOTTOM
CENTER
TOP
END

Figure 10

Figure 11



CORE FROM CENTER OF HALF CRATE
[WATER / POZZOLAN = 0.42]

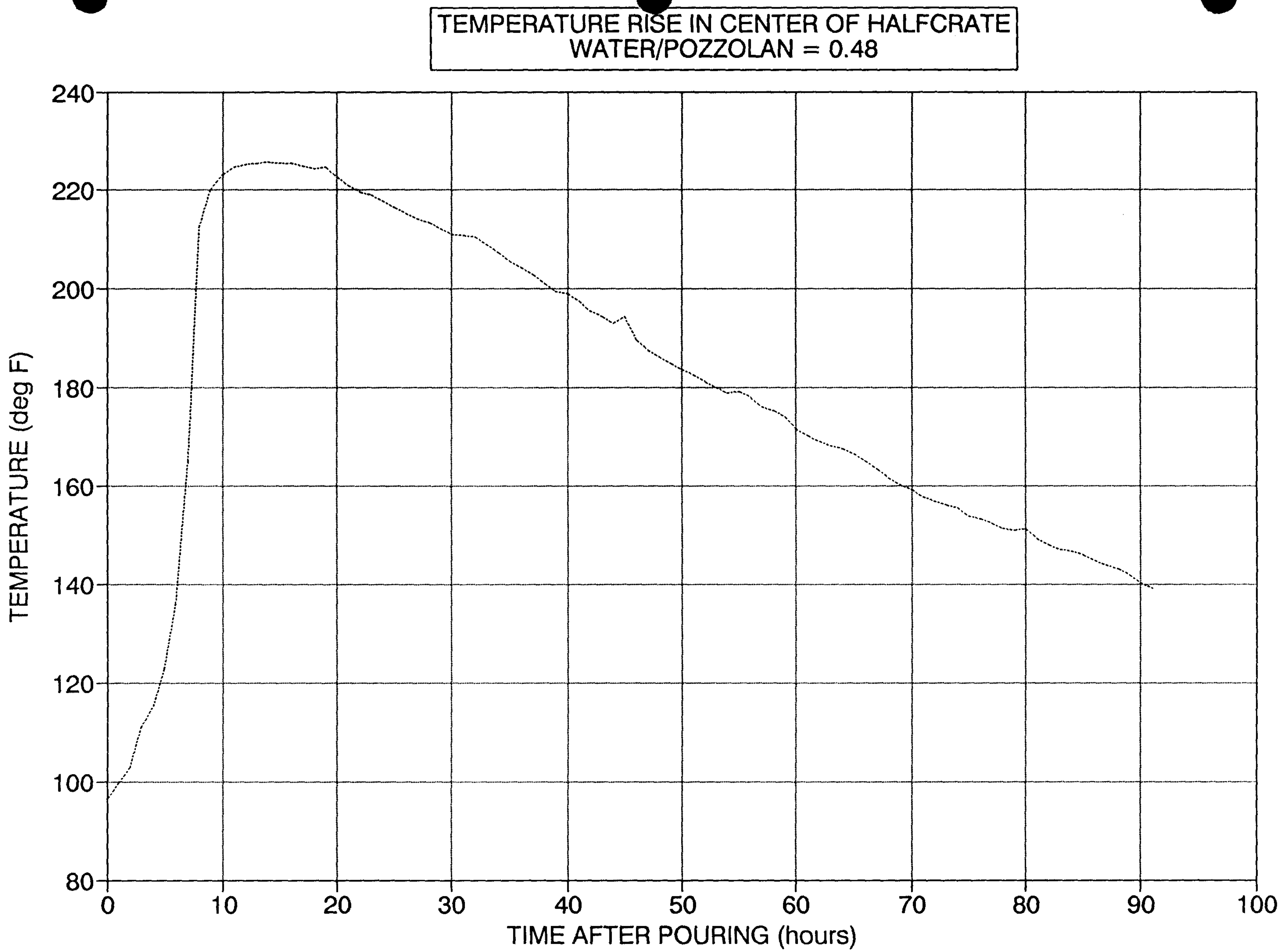
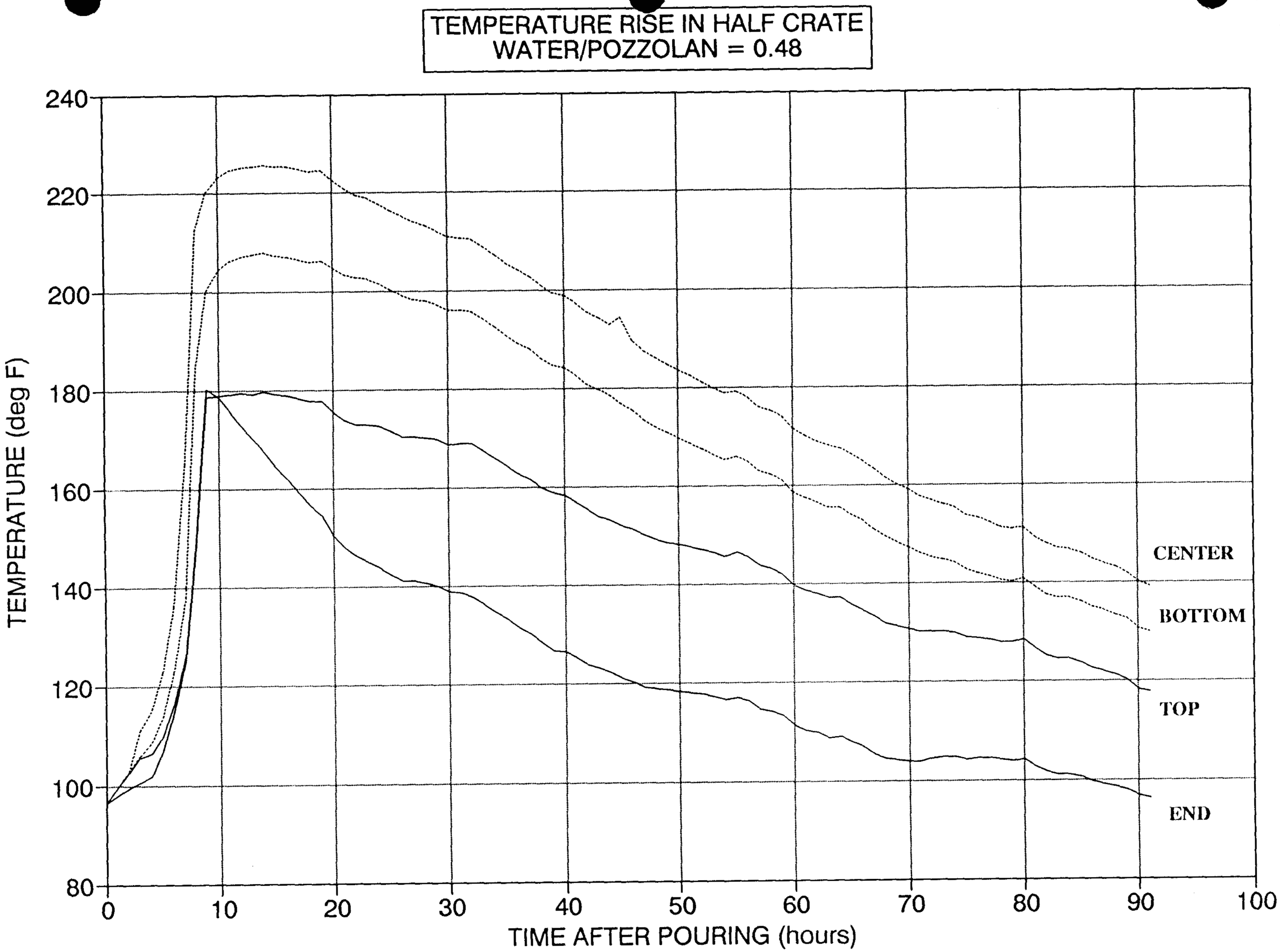

TEMPERATURE RISE IN CENTER OF HALFCRATE
WATER/POZZOLAN = 0.48
240
220
200
180
160
140
120
100
80
TEMPERATURE (deg F)
0
10
20
30
40
50
60
70
80
90
100
TIME AFTER POURING (hours)

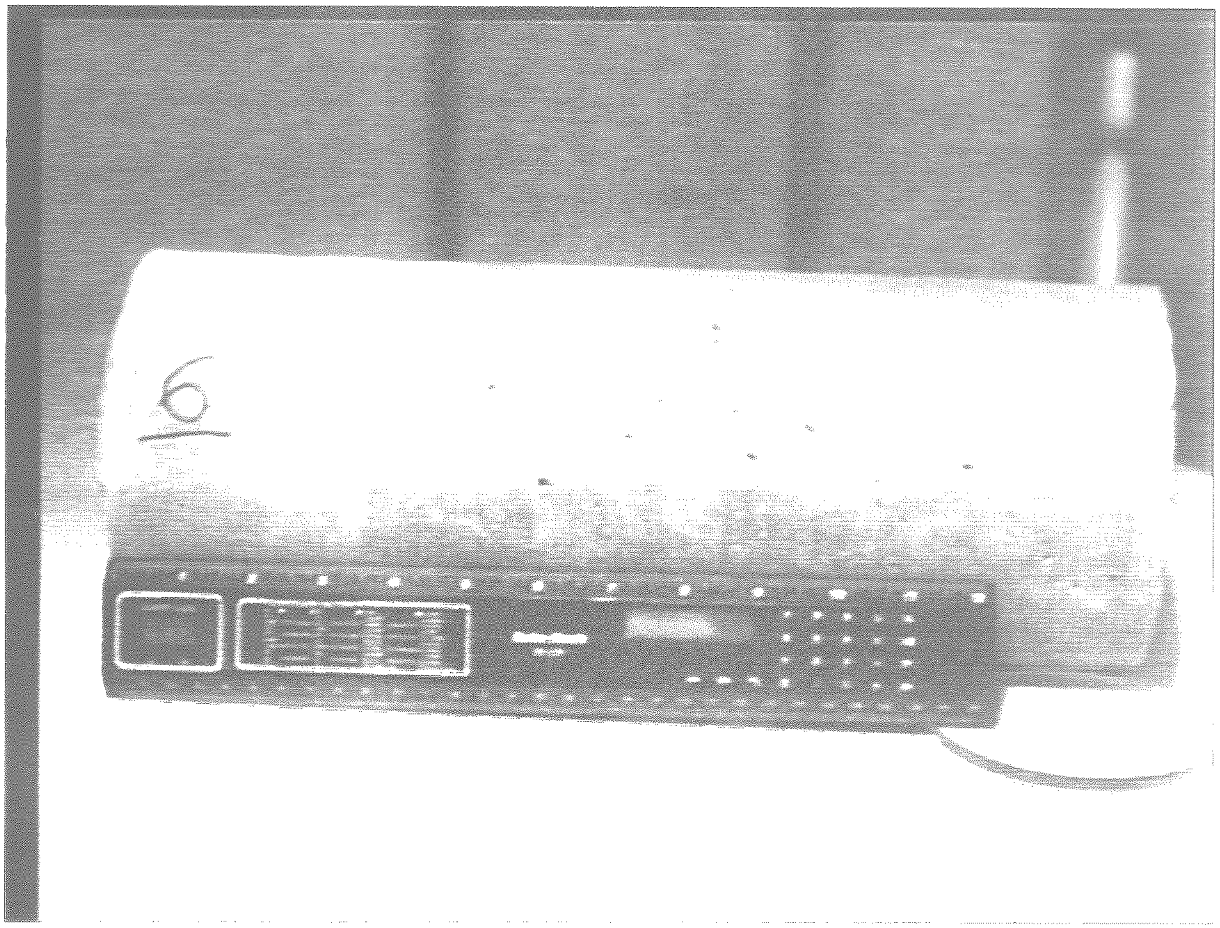
Figure 12



TEMPERATURE RISE IN HALF CRATE
WATER/POZZOLAN = 0.48
240
220
200
180
160
140
120
100
80
TEMPERATURE (deg F)
0
10
20
30
40
50
60
70
80
90
100
TIME AFTER POURING (hours)
CENTER
BOTTOM
TOP
END

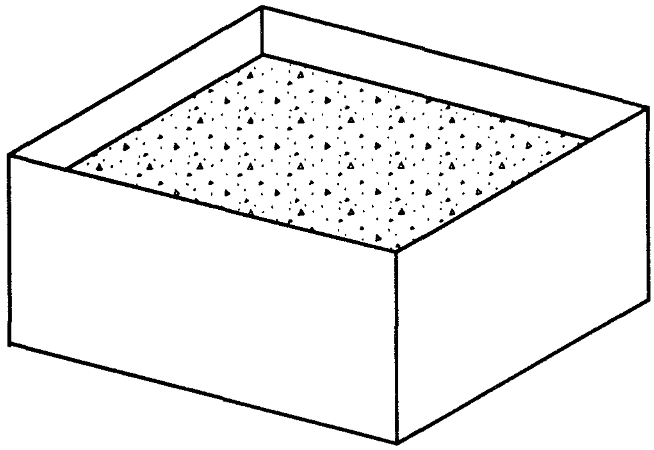
Figure 13

Figure 14



CORE FROM CENTER OF HALF CRATE
[WATER / POZZOLAN = 0.48]

IRREGULAR SHAPE A



IRREGULAR SHAPE B

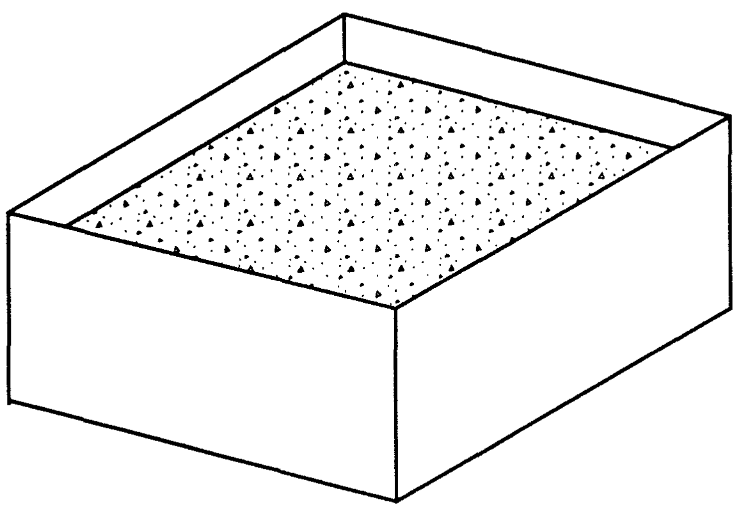


Figure 15

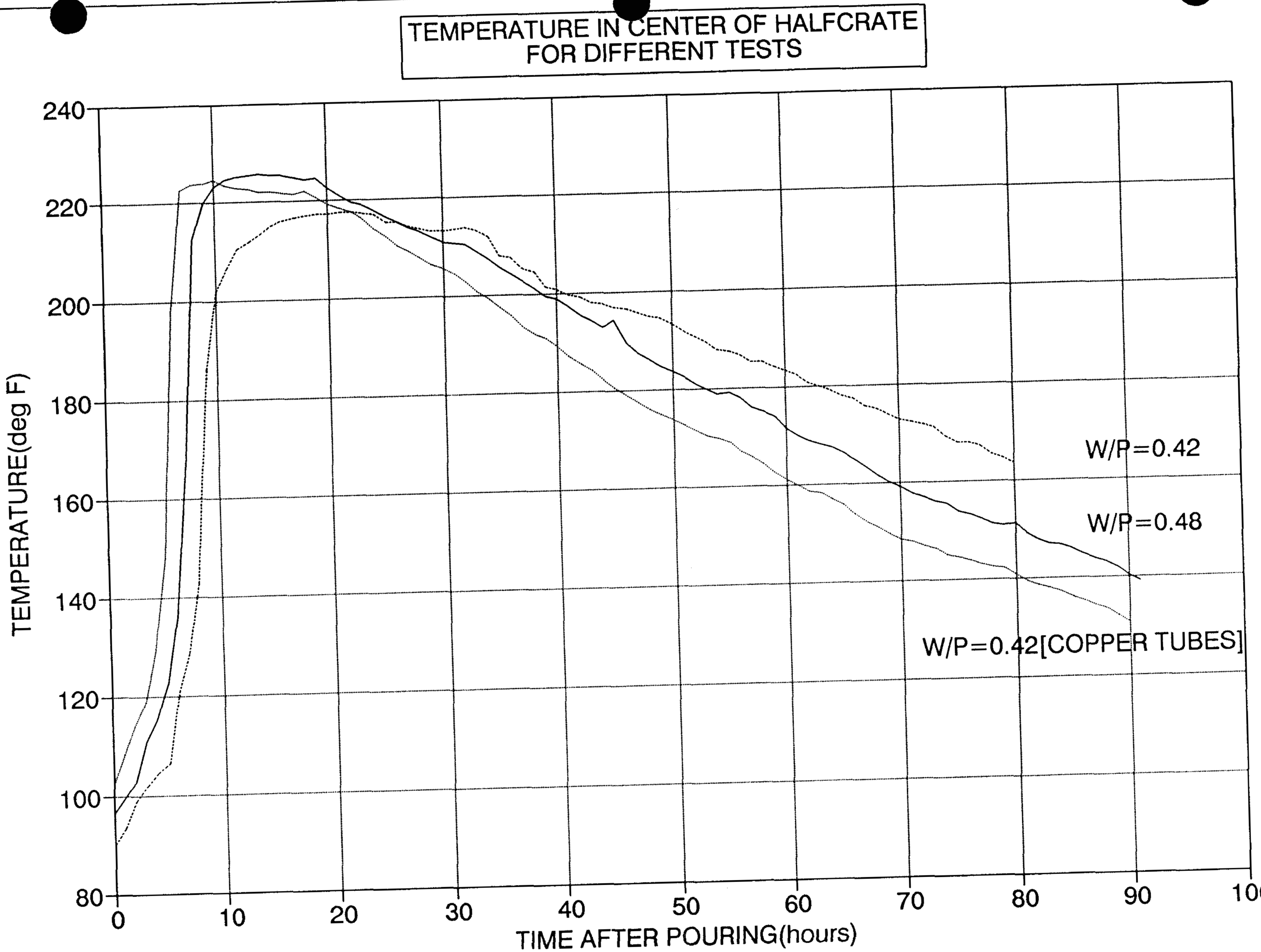

TEMPERATURE IN CENTER OF HALFCRATE
FOR DIFFERENT TESTS
240
220
200
180
160
140
120
100
80
TEMPERATURE(deg F)
0
10
20
30
40
50
60
70
80
90
100
TIME AFTER POURING(hours)
W/P=0.42
W/P=0.48
W/P=0.42[COPPER TUBES]

Figure 16

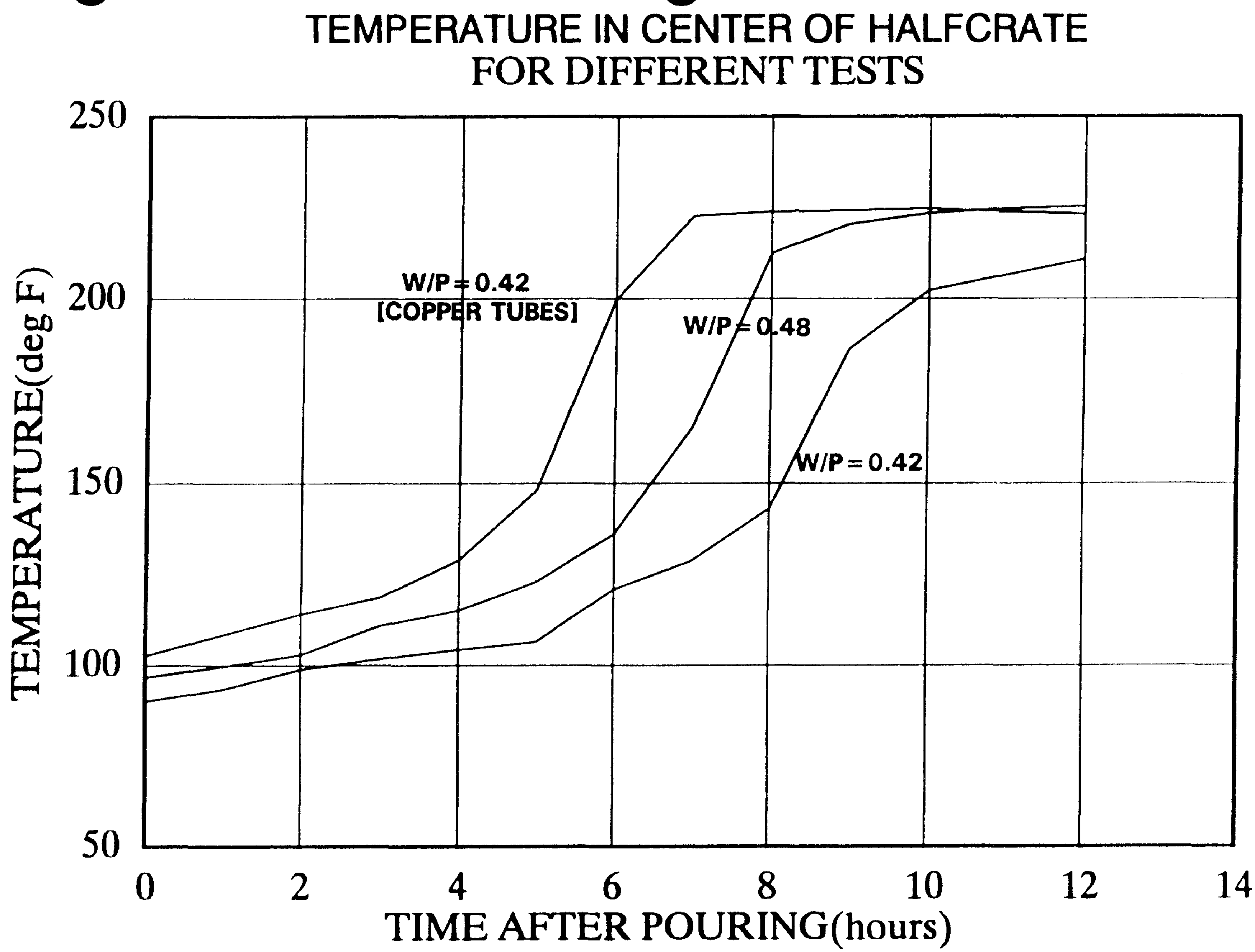
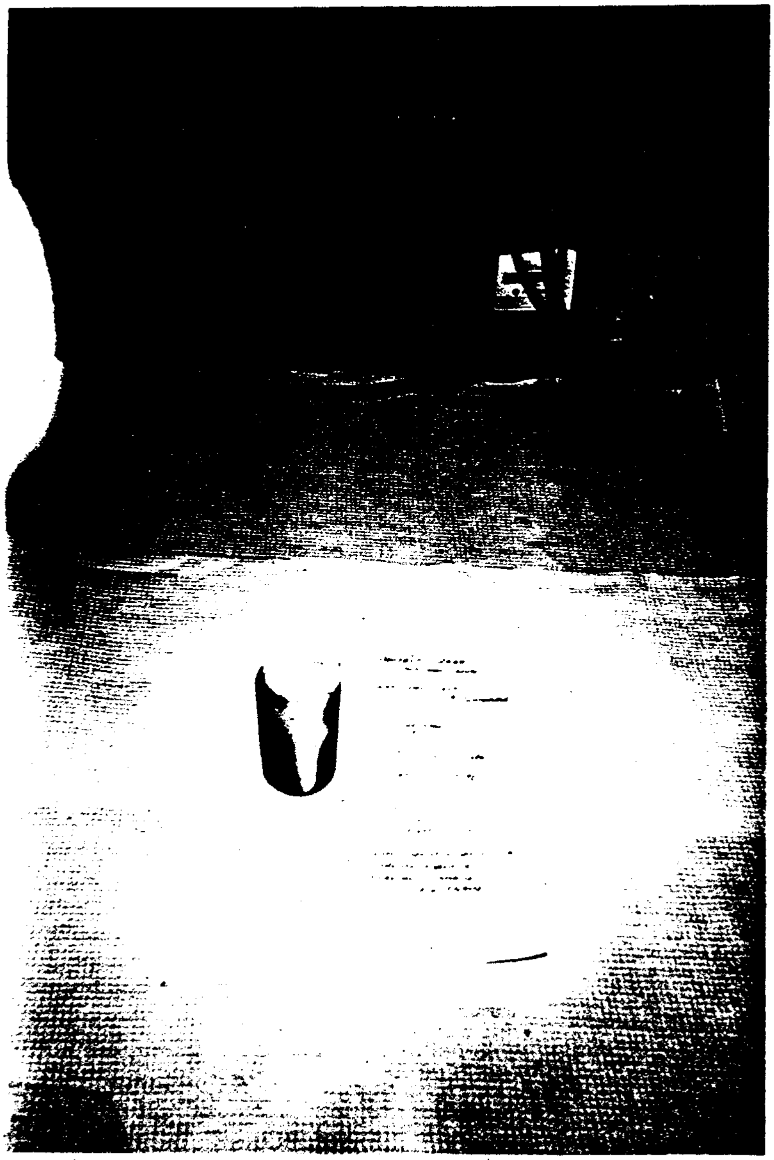

TEMPERATURE IN CENTER OF HALFCRATE
FOR DIFFERENT TESTS
TEMPERATURE(deg F)
250
200
150
100
50
0
2
4
6
8
10
12
14
TIME AFTER POURING(hours)
W/P = 0.42
[COPPER TUBES]
W/P = 0.48
W/P = 0.42

Figure 17

LIME/CEMENT/FLYASH AND SODIUM SILICATE

WET/DRY

8 CYLINDERS



ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

WET/DRY TEST
~~In cycle: #Completed~~ 5 cycles completed

CYLINDER NAME:
M1 1.2S

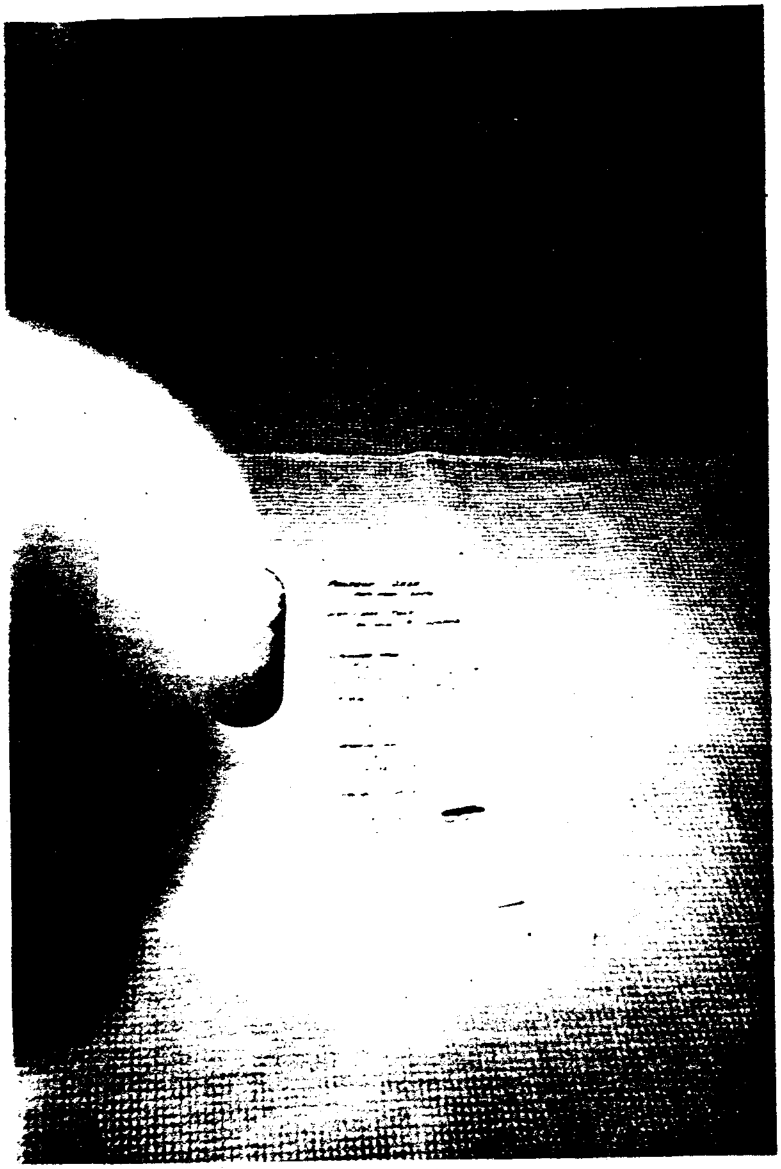
207C w/SILICATE

Mixed 1/17/92

OBSERVATIONS:
Dia: 2.00 in.
Height: 3.90 in.

Water separation during cure
Moderate elephant skin
Moderate scratching
Corner or end flaking

M1 1.2S



ROCKY FLATS
PROJECT NO. 2K68
Photo Taken: 2/1/92

WET/DRY TEST
~~In cycle: #Completed~~ 5 cycles completed

CYLINDER NAME:
M2 2.2S

207C CEMENT/FLYASH/LIME/SILICATE

Mixed 1/17/92

OBSERVATIONS:
Dia: 2.00 in.
Height: 4.01 in.

Moderate elephant skin/cracking
Very little scratching
Small amount end flaking

M2 2.2S

TABLE G-1

OUTPU[illegible]ODUCT SPECIFIC GRAVITIES FOR DIFFERENT TDS & TSS CONDITIONS FOR A WATER TO POZZOLAN RATIO O[illegible]

PECIFIC GRAVITY OF POZZOLANS	2.600	2.70	2.80	2.90	3.00	3.10	3.20	3.30	3.40
PECIFIC GRAVITY OF SALT	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251
PECIFIC GRAVITY OF SILT	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23
W/P RATIO	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34

TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.
0	0	0.00	0	1.000	1.849	1.886	1.922	1.957	1.990	2.022	2.054	2.084	2.113
0	2.5	0.00	2.5	1.014	1.851	1.888	1.924	1.958	1.991	2.024	2.055	2.085	2.114
0	5	0.00	5	1.028	1.853	1.890	1.926	1.960	1.993	2.025	2.056	2.086	2.115
0	7.5	0.00	7.5	1.043	1.856	1.892	1.927	1.962	1.994	2.026	2.057	2.087	2.115
0	10	0.00	10	1.058	1.858	1.894	1.929	1.963	1.996	2.028	2.058	2.088	2.116
0	12.5	0.00	12.5	1.074	1.860	1.897	1.931	1.965	1.998	2.029	2.059	2.089	2.117
0	15	0.00	15	1.090	1.863	1.899	1.934	1.967	1.999	2.030	2.061	2.090	2.118
2	0	2.00	0	1.014	1.853	1.890	1.926	1.961	1.994	2.026	2.058	2.088	2.117
2	2.5	1.95	2.5	1.028	1.855	1.892	1.928	1.962	1.995	2.028	2.059	2.089	2.118
2	5	1.90	5	1.042	1.858	1.894	1.930	1.964	1.997	2.029	2.060	2.090	2.118
2	7.5	1.85	7.5	1.057	1.860	1.896	1.932	1.966	1.998	2.030	2.061	2.090	2.119
2	10	1.80	10	1.073	1.862	1.898	1.934	1.967	2.000	2.032	2.062	2.091	2.120
2	12.5	1.75	12.5	1.088	1.865	1.901	1.936	1.969	2.002	2.033	2.063	2.092	2.121
2	15	1.70	15	1.104	1.867	1.903	1.938	1.971	2.003	2.034	2.064	2.094	2.122
4	0	4.00	0	1.028	1.858	1.895	1.930	1.965	1.998	2.030	2.062	2.092	2.121
4	2.5	3.90	2.5	1.043	1.860	1.897	1.932	1.966	2.000	2.032	2.063	2.093	2.122
4	5	3.80	5	1.057	1.862	1.899	1.934	1.968	2.001	2.033	2.064	2.094	2.122
4	7.5	3.70	7.5	1.072	1.864	1.901	1.936	1.970	2.003	2.034	2.065	2.094	2.123
4	10	3.60	10	1.087	1.866	1.903	1.938	1.971	2.004	2.036	2.066	2.095	2.124
4	12.5	3.50	12.5	1.103	1.869	1.905	1.940	1.973	2.006	2.037	2.067	2.096	2.125
4	15	3.40	15	1.119	1.871	1.907	1.942	1.975	2.007	2.038	2.068	2.097	2.126
6	0	6.00	0	1.043	1.862	1.899	1.935	1.969	2.002	2.035	2.066	2.096	2.125
6	2.5	5.85	2.5	1.057	1.864	1.901	1.936	1.971	2.004	2.036	2.067	2.097	2.126
6	5	5.70	5	1.072	1.866	1.903	1.938	1.972	2.005	2.037	2.068	2.098	2.126
6	7.5	5.55	7.5	1.087	1.869	1.905	1.940	1.974	2.007	2.038	2.069	2.099	2.127
6	10	5.40	10	1.102	1.871	1.907	1.942	1.976	2.008	2.040	2.070	2.099	2.128
6	12.5	5.25	12.5	1.118	1.873	1.909	1.944	1.978	2.010	2.041	2.071	2.100	2.129
6	15	5.10	15	1.134	1.876	1.912	1.946	1.980	2.012	2.043	2.073	2.102	2.130
8	0	8.00	0	1.059	1.867	1.904	1.939	1.974	2.007	2.039	2.070	2.100	2.129
8	2.5	7.80	2.5	1.073	1.869	1.906	1.941	1.975	2.008	2.040	2.071	2.101	2.130
8	5	7.60	5	1.087	1.871	1.907	1.943	1.977	2.010	2.041	2.072	2.102	2.131
8	7.5	7.40	7.5	1.102	1.873	1.910	1.945	1.979	2.011	2.043	2.073	2.103	2.131
8	10	7.20	10	1.117	1.876	1.912	1.947	1.980	2.013	2.044	2.074	2.104	2.132
8	12.5	7.00	12.5	1.133	1.878	1.914	1.949	1.982	2.014	2.046	2.076	2.105	2.133
8	15	6.80	15	1.149	1.881	1.916	1.951	1.984	2.016	2.047	2.077	2.106	2.134
10	0	10.00	0	1.074	1.871	1.908	1.944	1.978	2.011	2.044	2.075	2.105	2.134
10	2.5	9.75	2.5	1.088	1.873	1.910	1.946	1.980	2.013	2.045	2.076	2.105	2.134
10	5	9.50	5	1.103	1.876	1.912	1.947	1.981	2.014	2.046	2.077	2.106	2.135
10	7.5	9.25	7.5	1.118	1.878	1.914	1.949	1.983	2.016	2.047	2.078	2.107	2.136
10	10	9.00	10	1.133	1.880	1.916	1.951	1.985	2.017	2.049	2.079	2.108	2.136
10	12.5	8.75	12.5	1.149	1.883	1.919	1.953	1.987	2.019	2.050	2.080	2.109	2.137
10	15	8.50	15	1.165	1.885	1.921	1.955	1.989	2.021	2.051	2.081	2.110	2.138
12	0	12.00	0	1.091	1.876	1.913	1.949	1.983	2.016	2.048	2.079	2.109	2.138
12	2.5	11.70	2.5	1.105	1.878	1.915	1.951	1.985	2.018	2.049	2.080	2.110	2.139
12	5	11.40	5	1.119	1.881	1.917	1.952	1.986	2.019	2.051	2.081	2.111	2.139
12	7.5	11.10	7.5	1.134	1.883	1.919	1.954	1.988	2.021	2.052	2.082	2.112	2.140
12	10	10.80	10	1.149	1.885	1.921	1.956	1.990	2.022	2.053	2.083	2.113	2.141
12	12.5	10.50	12.5	1.165	1.888	1.924	1.958	1.992	2.024	2.055	2.085	2.114	2.142
12	15	10.20	15	1.181	1.890	1.926	1.960	1.993	2.025	2.056	2.086	2.115	2.142
14	0	14.00	0	1.107	1.881	1.918	1.954	1.988	2.021	2.053	2.084	2.114	2.143
14	2.5	13.65	2.5	1.121	1.884	1.920	1.956	1.990	2.023	2.054	2.085	2.115	2.144
14	5	13.30	5	1.136	1.886	1.922	1.957	1.991	2.024	2.056	2.086	2.116	2.144
14	7.5	12.95	7.5	1.151	1.888	1.924	1.959	1.993	2.025	2.057	2.087	2.116	2.145
14	10	12.60	10	1.166	1.890	1.926	1.961	1.995	2.027	2.058	2.088	2.117	2.145
14	12.5	12.25	12.5	1.182	1.893	1.929	1.963	1.997	2.029	2.060	2.089	2.118	2.146
14	15	11.90	15	1.198	1.896	1.931	1.965	1.998	2.030	2.061	2.091	2.119	2.147
16	0	16.00	0	1.125	1.887	1.924	1.959	1.993	2.026	2.058	2.089	2.119	2.148
16	2.5	15.60	2.5	1.139	1.889	1.926	1.961	1.995	2.028	2.059	2.090	2.120	2.148
16	5	15.20	5	1.153	1.891	1.928	1.963	1.996	2.029	2.061	2.091	2.121	2.149
16	7.5	14.80	7.5	1.168	1.893	1.930	1.964	1.998	2.031	2.062	2.092	2.121	2.150
16	10	14.40	10	1.183	1.896	1.932	1.966	2.000	2.032	2.063	2.093	2.122	2.150
16	12.5	14.00	12.5	1.199	1.898	1.934	1.969	2.002	2.034	2.065	2.094	2.123	2.151
16	15	13.60	15	1.215	1.901	1.936	1.971	2.004	2.035	2.066	2.096	2.124	2.152
18	0	18.00	0	1.142	1.892	1.929	1.964	1.999	2.032	2.064	2.094	2.124	2.153
18	2.5	17.55	2.5	1.156	1.894	1.931	1.966	2.000	2.033	2.065	2.095	2.125	2.153
18	5	17.10	5	1.171	1.897	1.933	1.968	2.002	2.034	2.066	2.096	2.126	2.154
18	7.5	16.65	7.5	1.186	1.899	1.935	1.970	2.004	2.036	2.067	2.097	2.126	2.155
18	10	16.20	10	1.201	1.901	1.937	1.972	2.005	2.037	2.068	2.098	2.127	2.155
18	12.5	15.75	12.5	1.217	1.904	1.940	1.974	2.007	2.039	2.070	2.099	2.128	2.156
18	15	15.30	15	1.233	1.907	1.942	1.976	2.009	2.041	2.071	2.101	2.129	2.157
20	0	20.00	0	1.161	1.898	1.935	1.970	2.004	2.037	2.069	2.100	2.129	2.158
20	2.5	19.50	2.5	1.175	1.900	1.937	1.972	2.006	2.039	2.070	2.101	2.130	2.159
20	5	19.00	5	1.189	1.902	1.939	1.974	2.007	2.040	2.071	2.102	2.131	2.159
20	7.5	18.50	7.5	1.204	1.905	1.941	1.976	2.009	2.041	2.073	2.103	2.132	2.160
20	10	18.00	10	1.219	1.907	1.943	1.978	2.011	2.043	2.074	2.104	2.133	2.160
20	12.5	17.50	12.5	1.235	1.910	1.945	1.980	2.013	2.044	2.075	2.105	2.133	2.161
20	15	17.00	15	1.251	1.912	1.948	1.982	2.014	2.046	2.077	2.106	2.134	2.162
22	0	22.00	0	1.180	1.904	1.941	1.976	2.010	2.043	2.075	2.105	2.135	2.164
22	2.5	21.45	2.5	1.194	1.906	1.943	1.978	2.012	2.044	2.076	2.106	2.136	2.164
22	5	20.90	5	1.208	1.908	1.945	1.980	2.013	2.046	2.077	2.107	2.137	2.165
22	7.5	20.35	7.5	1.223	1.911	1.947	1.981	2.015	2.047	2.078	2.108	2.137	2.165
22	10	19.80	10	1.238	1.913	1.949	1.983	2.017	2.049	2.079	2.109	2.138	2.166
22	12.5	19.25	12.5	1.253	1.916	1.951	1.985	2.018	2.050	2.081	2.110	2.139	2.166
22	15	18.70	15	1.269	1.918	1.954	1.988	2.020	2.052	2.082	2.111	2.140	2.167
24	0	24.00	0	1.199	1.910	1.947	1.982	2.016	2.049	2.081	2.111	2.141	2.169
24	2.5	23.40	2.5	1.213	1.913	1.949	1.984	2.018	2.050	2.082	2.112	2.142	2.170
24	5	22.80	5	1.228	1.915	1.951	1.986	2.019	2.052	2.083	2.113	2.142	2.170
24	7.5	22.20	7.5	1.242	1.917	1.953	1.988	2.021	2.053	2.084	2.114	2.143	2.171
24	10	21.60	10	1.257	1.919	1.955	1.990	2.023	2.055	2.085	2.115	2.144	2.171
24	12.5	21.00	12.5	1.273	1.922	1.957	1.992	2.024	2.056	2.087	2.116	2.145	2.172
24	15	20.40	15	1.289	1.925	1.960	1.994	2.026	2.058	2.088	2.117	2.145	2.173
26	0	26.00	0	1.220	1.917	1.953	1.989	2.023	2.055	2.087	2.117	2.147	2.175
26	2.5	25.35	2.5	1.234	1.919	1.955	1.990	2.024	2.057	2.088	2.118	2.148	2.176
26	5	24.70	5	1.248	1.921	1.957	1.992	2.026	2.058	2.089	2.119	2.148	2.176
26	7.5	24.05	7.5	1.262	1.924	1.960	1.994	2.027	2.059	2.090	2.120	2.149	2.177
26	10	23.40	10	1.277	1.926	1.962	1.996	2.029	2.061	2.091	2.121	2.150	2.177
26	12.5	22.75	12.5	1.293	1.929	1.964	1.998	2.031	2.062	2.093	2.122	2.150	2.178
26	15	22.10	15	1.308	1.931	1.966	2.000	2.033	2.064	2.094	2.123	2.151	2.178
28	0	28.00	0	1.240	1.924	1.960	1.995	2.029	2.062	2.093	2.124	2.153	2.182
28	2.5	27.30	2.5	1.254	1.926	1.962	1.997	2.031	2.063	2.094	2.125	2.154	2.182
28	5	26.60	5	1.269	1.928	1.964	1.999	2.032	2.065	2.096	2.126	2.155	2.183
28	7.5	25.90	7.5	1.283	1.930	1.966	2.001	2.034	2.066	2.097	2.126	2.155	2.183
28	10	25.20	10	1.298	1.933	1.968	2.003	2.036	2.067	2.098	2.127	2.156	2.183
28	12.5	24.50	12.5	1.313	1.935	1.971	2.005	2.037	2.069	2.099	2.128	2.157	2.184
28	15	23.80	15	1.329	1.938	1.973	2.007	2.039	2.070	2.100	2.129	2.157	2.184
30	0	30.00	0	1.262	1.931	1.967	2.002	2.036	2.069	2.100	2.131	2.160	2.188
30	2.5	29.25	2.5	1.276	1.933	1.969	2.004	2.038	2.070	2.101	2.131	2.160	2.189
30	5	28.50	5	1.290	1.935	1.971	2.006	2.039	2.071	2.102	2.132	2.161	2.189
30	7.5	27.75	7.5	1.305	1.938	1.973	2.008	2.041	2.073	2.103	2.133	2.162	2.189
30	10	27.00	10	1.319	1.940	1.975	2.010	2.042	2.074	2.105	2.134	2.162	2.190
30	12.5	26.25	12.5	1.335	1.943	1.978	2.012	2.044	2.075	2.106	2.135	2.163	2.190
30	15	25.50	15	1.350	1.945	1.980	2.014	2.046	2.077	2.107	2.136	2.164	2.191
32	0	32.00	0	1.285	1.938	1.975	2.010	2.043	2.076	2.107	2.138	2.167	2.195
32	2.5	31.20	2.5	1.298	1.941	1.977	2.011	2.045	2.077	2.108	2.138	2.167	2.195
32	5	30.40	5	1.312	1.943	1.979	2.013	2.046	2.078	2.109	2.139	2.168	2.196
32	7.5	29.60	7.5	1.327	1.945	1.981	2.015	2.048	2.080	2.110	2.140	2.168	2.196
32	10	28.80	10	1.342	1.948	1.983	2.017	2.050	2.081	2.111	2.141	2.169	2.196
32	12.5	28.00	12.5	1.357	1.950	1.985	2.019	2.051	2.083	2.113	2.142	2.170	2.197
32	15	27.20	15	1.372	1.953	1.987	2.021	2.053	2.084	2.114	2.143	2.170	2.197
34	0	34.00	0	1.308	1.946	1.983	2.017	2.051	2.084	2.115	2.145	2.174	2.202
34	2.5	33.15	2.5	1.322	1.948	1.984	2.019	2.052	2.085	2.116	2.146	2.175	2.203
34	5	32.30	5	1.336	1.951	1.986	2.021	2.054	2.086	2.117	2.146	2.175	2.203
34	7.5	31.45	7.5	1.350	1.953	1.988	2.023	2.056	2.087	2.118	2.147	2.176	2.203
34	10	30.60	10	1.364	1.955	1.991	2.024	2.057	2.089	2.119	2.148	2.176	2.203
34	12.5	29.75	12.5	1.379	1.958	1.993	2.026	2.059	2.090	2.120	2.149	2.177	2.204
34	15	28.90	15	1.394	1.960	1.995	2.028	2.060	2.091	2.121	2.150	2.177	2.204
36	0	36.00	0	1.332	1.955	1.991	2.026	2.059	2.091	2.123	2.153	2.182	2.210
36	2.5	35.10	2.5	1.346	1.957	1.993	2.027	2.060	2.093	2.123	2.153	2.182	2.210
36	5	34.20	5	1.359	1.959	1.995	2.029	2.062	2.094	2.124	2.154	2.183	2.210
36	7.5	33.30	7.5	1.374	1.961	1.997	2.031	2.063	2.095	2.125	2.155	2.183	2.210
36	10	32.40	10	1.388	1.964	1.999	2.032	2.065	2.096	2.126	2.155	2.183	2.211
36	12.5	31.50	12.5	1.403	1.966	2.001	2.034	2.067	2.098	2.127	2.156	2.184	2.211
36	15	30.60	15	1.418	1.969	2.003	2.036	2.068	2.099	2.128	2.157	2.184	2.211
38	0	38.00	0	1.357	1.963	1.999	2.034	2.067	2.100	2.131	2.161	2.190	2.218
38	2.5	37.05	2.5	1.370	1.965	2.001	2.035	2.069	2.101	2.132	2.161	2.190	2.218
38	5	36.10	5	1.384	1.967	2.003	2.037	2.070	2.102	2.133	2.162	2.190	2.218
38	7.5	35.15	7.5	1.398	1.970	2.005	2.039	2.072	2.103	2.133	2.163	2.191	2.218
38	10	34.20	10	1.412	1.972	2.007	2.041	2.073	2.104	2.134	2.163	2.191	2.218
38	12.5	33.25	12.5	1.427	1.975	2.009	2.043	2.075	2.106	2.135	2.164	2.192	2.218
38	15	32.30	15	1.442	1.977	2.012	2.045	2.076	2.107	2.136	2.165	2.192	2.218
40	0	40.00	0	1.383	1.972	2.008	2.043	2.076	2.108	2.139	2.169	2.198	2.226
40	2.5	39.00	2.5	1.396	1.974	2.010	2.045	2.078	2.109	2.140	2.170	2.198	2.226
40	5	38.00	5	1.410	1.977	2.012	2.046	2.079	2.111	2.141	2.170	2.199	2.226
40	7.5	37.00	7.5	1.424	1.979	2.014	2.048	2.080	2.112	2.142	2.171	2.199	2.226
40	10	36.00	10	1.438	1.981	2.016	2.050	2.082	2.113	2.143	2.172	2.199	2.226
40	12.5	35.00	12.5	1.452	1.984	2.018	2.051	2.083	2.114	2.144	2.172	2.200	2.226
40	15	34.00	15	1.467	1.986	2.020	2.053	2.085	2.115	2.145	2.173	2.200	2.226

LINEAR REGRESSION OF INPUT SP. GR. vS OUTPUT SP. GR.

Regression Output	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4
Constant	1.529783	1.571018	1.611155	1.650231	1.688283	1.7253438684667	1.7614482664713	1.7966284874793	1.830916
Std Err of Y Est	0.004863	0.005187	0.005511	0.005832	0.006152	0.0064680297226591	0.0067812262197023	0.0070908334141236	0.007397
R Squared	0.983210	0.980413	0.977306	0.973871	0.970090	0.96594475620306	0.96141555225627	0.95648279109431	0.951126
No. of Observations	147	147	147	147	147	147	147	147	147
Degrees of Freedom	145	145	145	145	145	145	145	145	145
X Coefficient(s)	0.312374	0.308063	0.303559	0.298890	0.294084	0.289163	0.284147	0.279056	0.273904
Std Err of Coef.	0.003390	0.003616	0.003841	0.004066	0.004288	0.004509	0.004727	0.004943	0.005156

(Each column: "For Pozzolan Sp. Gr. of 2.6" … "of 3.4".)

POZZOLAN SPECIFIC GRAVITY	X COEFF-ICIENT m	Y INTER-CEPT c
2.6	0.3123743	1.5297828
2.7	0.3080632	1.5710176
2.8	0.3035585	1.6111549
2.9	0.2988900	1.6502313
3.0	0.2940836	1.6882828
3.1	0.2891626	1.7253439
3.2	0.2841474	1.7614483
3.3	0.2790560	1.7966285
3.4	0.2739044	1.8309160

LINEAR REGRESSION OF X COEFFICIENT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant	0.438419
Std Err of Y Est	0.000395
R Squared	0.999217
No. of Observations	9
Degrees of Freedom	7
X Coefficient(s)	-0.048242
Std Err of Coef.	0.000510

LINEAR REGRESSION OF Y INTERCEPT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant	0.556446
Std Err of Y Est	0.003290
R Squared	0.999108
No. of Observations	9
Degrees of Freedom	7
X Coefficient(s)	0.376177
Std Err of Coef.	0.004248

TABLE G-2

OUTPU DUCT SPECIFIC GRAVITIES FOR DIFFERENT TDS & TSS CONDITIONS FOR A WATER TO POZZOLAN RATIO O

PECIFIC GRAVITY OF POZZOLANS	2.600	2.70	2.80	2.90	3.00	3.10	3.20	3.30	3.40
PECIFIC GRAVITY OF SALT	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251
PECIFIC GRAVITY OF SILT	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23
W/P RATIO	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36

TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.
0	0	0.00	0	1.000	1.826	1.862	1.896	1.930	1.962	1.992	2.022	2.051	2.079
0	2.5	0.00	2.5	1.014	1.829	1.864	1.898	1.931	1.963	1.994	2.024	2.052	2.080
0	5	0.00	5	1.028	1.831	1.866	1.900	1.933	1.965	1.995	2.025	2.053	2.081
0	7.5	0.00	7.5	1.043	1.833	1.869	1.902	1.935	1.967	1.997	2.026	2.055	2.082
0	10	0.00	10	1.058	1.836	1.871	1.905	1.937	1.968	1.999	2.028	2.056	2.083
0	12.5	0.00	12.5	1.074	1.839	1.873	1.907	1.939	1.970	2.000	2.029	2.057	2.084
0	15	0.00	15	1.090	1.841	1.876	1.909	1.941	1.972	2.002	2.031	2.059	2.085
2	0	2.00	0	1.014	1.831	1.866	1.901	1.934	1.966	1.997	2.026	2.055	2.083
2	2.5	1.95	2.5	1.028	1.833	1.868	1.903	1.936	1.967	1.998	2.028	2.056	2.084
2	5	1.90	5	1.042	1.835	1.871	1.905	1.937	1.969	2.000	2.029	2.058	2.085
2	7.5	1.85	7.5	1.057	1.838	1.873	1.907	1.939	1.971	2.001	2.030	2.059	2.086
2	10	1.80	10	1.073	1.840	1.875	1.909	1.941	1.973	2.003	2.032	2.060	2.087
2	12.5	1.75	12.5	1.088	1.843	1.878	1.911	1.943	1.974	2.004	2.033	2.061	2.088
2	15	1.70	15	1.104	1.846	1.880	1.913	1.945	1.976	2.006	2.035	2.063	2.089
4	0	4.00	0	1.028	1.835	1.871	1.905	1.938	1.970	2.001	2.031	2.059	2.087
4	2.5	3.90	2.5	1.043	1.837	1.873	1.907	1.940	1.972	2.002	2.032	2.061	2.088
4	5	3.80	5	1.057	1.840	1.875	1.909	1.942	1.973	2.004	2.033	2.062	2.089
4	7.5	3.70	7.5	1.072	1.842	1.877	1.911	1.944	1.975	2.005	2.035	2.063	2.090
4	10	3.60	10	1.087	1.845	1.880	1.913	1.946	1.977	2.007	2.036	2.064	2.091
4	12.5	3.50	12.5	1.103	1.847	1.882	1.916	1.948	1.979	2.009	2.038	2.065	2.092
4	15	3.40	15	1.119	1.850	1.885	1.918	1.950	1.981	2.010	2.039	2.067	2.093
6	0	6.00	0	1.043	1.840	1.875	1.910	1.943	1.975	2.005	2.035	2.064	2.092
6	2.5	5.85	2.5	1.057	1.842	1.877	1.912	1.944	1.976	2.007	2.036	2.065	2.093
6	5	5.70	5	1.072	1.844	1.880	1.914	1.946	1.978	2.008	2.038	2.066	2.094
6	7.5	5.55	7.5	1.087	1.847	1.882	1.916	1.948	1.980	2.010	2.039	2.067	2.095
6	10	5.40	10	1.102	1.850	1.884	1.918	1.950	1.981	2.011	2.040	2.068	2.096
6	12.5	5.25	12.5	1.118	1.852	1.887	1.920	1.952	1.983	2.013	2.042	2.070	2.097
6	15	5.10	15	1.134	1.855	1.889	1.923	1.954	1.985	2.015	2.043	2.071	2.098
8	0	8.00	0	1.059	1.845	1.880	1.914	1.947	1.979	2.010	2.040	2.068	2.096
8	2.5	7.80	2.5	1.073	1.847	1.882	1.916	1.949	1.981	2.011	2.041	2.069	2.097
8	5	7.60	5	1.087	1.849	1.884	1.918	1.951	1.982	2.013	2.042	2.071	2.098
8	7.5	7.40	7.5	1.102	1.852	1.887	1.920	1.953	1.984	2.014	2.044	2.072	2.099
8	10	7.20	10	1.117	1.854	1.889	1.923	1.955	1.986	2.016	2.045	2.073	2.100
8	12.5	7.00	12.5	1.133	1.857	1.892	1.925	1.957	1.988	2.018	2.046	2.074	2.101
8	15	6.80	15	1.149	1.860	1.894	1.927	1.959	1.990	2.019	2.048	2.075	2.102
10	0	10.00	0	1.074	1.850	1.885	1.919	1.952	1.984	2.015	2.044	2.073	2.101
10	2.5	9.75	2.5	1.088	1.852	1.887	1.921	1.954	1.986	2.016	2.046	2.074	2.102
10	5	9.50	5	1.103	1.854	1.889	1.923	1.956	1.987	2.018	2.047	2.075	2.103
10	7.5	9.25	7.5	1.118	1.857	1.892	1.925	1.958	1.989	2.019	2.048	2.076	2.104
10	10	9.00	10	1.133	1.859	1.894	1.928	1.960	1.991	2.021	2.050	2.078	2.105
10	12.5	8.75	12.5	1.149	1.862	1.897	1.930	1.962	1.993	2.022	2.051	2.079	2.106
10	15	8.50	15	1.165	1.865	1.899	1.932	1.964	1.995	2.024	2.053	2.080	2.107
12	0	12.00	0	1.091	1.855	1.890	1.924	1.957	1.989	2.020	2.049	2.078	2.106
12	2.5	11.70	2.5	1.105	1.857	1.892	1.926	1.959	1.991	2.021	2.051	2.079	2.106
12	5	11.40	5	1.119	1.859	1.895	1.928	1.961	1.992	2.023	2.052	2.080	2.107
12	7.5	11.10	7.5	1.134	1.862	1.897	1.930	1.963	1.994	2.024	2.053	2.081	2.108
12	10	10.80	10	1.149	1.865	1.899	1.933	1.965	1.996	2.026	2.054	2.082	2.109
12	12.5	10.50	12.5	1.165	1.867	1.902	1.935	1.967	1.998	2.027	2.056	2.084	2.110
12	15	10.20	15	1.181	1.870	1.904	1.937	1.969	2.000	2.029	2.057	2.085	2.111
14	0	14.00	0	1.107	1.860	1.896	1.930	1.963	1.994	2.025	2.054	2.083	2.111
14	2.5	13.65	2.5	1.121	1.862	1.898	1.932	1.964	1.996	2.026	2.056	2.084	2.111
14	5	13.30	5	1.136	1.865	1.900	1.934	1.966	1.997	2.028	2.057	2.085	2.112
14	7.5	12.95	7.5	1.151	1.867	1.902	1.936	1.968	1.999	2.029	2.058	2.086	2.113
14	10	12.60	10	1.166	1.870	1.905	1.938	1.970	2.001	2.031	2.060	2.087	2.114
14	12.5	12.25	12.5	1.182	1.873	1.907	1.940	1.972	2.003	2.032	2.061	2.089	2.115
14	15	11.90	15	1.198	1.876	1.910	1.943	1.974	2.005	2.034	2.062	2.090	2.116
16	0	16.00	0	1.125	1.866	1.901	1.935	1.968	2.000	2.030	2.060	2.088	2.116
16	2.5	15.60	2.5	1.139	1.868	1.903	1.937	1.970	2.001	2.032	2.061	2.089	2.117
16	5	15.20	5	1.153	1.870	1.905	1.939	1.972	2.003	2.033	2.062	2.090	2.117
16	7.5	14.80	7.5	1.168	1.873	1.908	1.941	1.973	2.005	2.034	2.063	2.091	2.118
16	10	14.40	10	1.183	1.876	1.910	1.943	1.975	2.006	2.036	2.065	2.092	2.119
16	12.5	14.00	12.5	1.199	1.878	1.913	1.946	1.977	2.008	2.038	2.066	2.094	2.120
16	15	13.60	15	1.215	1.881	1.915	1.948	1.980	2.010	2.039	2.068	2.095	2.121
18	0	18.00	0	1.142	1.871	1.907	1.941	1.974	2.005	2.036	2.065	2.094	2.121
18	2.5	17.55	2.5	1.156	1.874	1.909	1.943	1.975	2.007	2.037	2.066	2.095	2.122
18	5	17.10	5	1.171	1.876	1.911	1.945	1.977	2.008	2.039	2.068	2.096	2.123
18	7.5	16.65	7.5	1.186	1.879	1.914	1.947	1.979	2.010	2.040	2.069	2.097	2.124
18	10	16.20	10	1.201	1.881	1.916	1.949	1.981	2.012	2.042	2.070	2.098	2.125
18	12.5	15.75	12.5	1.217	1.884	1.918	1.951	1.983	2.014	2.043	2.072	2.099	2.125
18	15	15.30	15	1.233	1.887	1.921	1.954	1.985	2.016	2.045	2.073	2.100	2.126
20	0	20.00	0	1.161	1.878	1.913	1.947	1.979	2.011	2.041	2.071	2.099	2.127
20	2.5	19.50	2.5	1.175	1.880	1.915	1.949	1.981	2.013	2.043	2.072	2.100	2.127
20	5	19.00	5	1.189	1.882	1.917	1.951	1.983	2.014	2.044	2.073	2.101	2.128
20	7.5	18.50	7.5	1.204	1.885	1.919	1.953	1.985	2.016	2.046	2.075	2.102	2.129
20	10	18.00	10	1.219	1.887	1.922	1.955	1.987	2.018	2.047	2.076	2.103	2.130
20	12.5	17.50	12.5	1.235	1.890	1.924	1.957	1.989	2.019	2.049	2.077	2.105	2.131
20	15	17.00	15	1.251	1.893	1.927	1.960	1.991	2.021	2.050	2.079	2.106	2.132
22	0	22.00	0	1.180	1.884	1.919	1.953	1.986	2.017	2.048	2.077	2.105	2.133
22	2.5	21.45	2.5	1.194	1.886	1.921	1.955	1.987	2.019	2.049	2.078	2.106	2.133
22	5	20.90	5	1.208	1.889	1.923	1.957	1.989	2.020	2.050	2.079	2.107	2.134
22	7.5	20.35	7.5	1.223	1.891	1.926	1.959	1.991	2.022	2.052	2.080	2.108	2.135
22	10	19.80	10	1.238	1.894	1.928	1.961	1.993	2.024	2.053	2.082	2.109	2.136
22	12.5	19.25	12.5	1.253	1.897	1.931	1.963	1.995	2.025	2.055	2.083	2.110	2.137
22	15	18.70	15	1.269	1.899	1.933	1.966	1.997	2.027	2.056	2.084	2.111	2.137
24	0	24.00	0	1.199	1.890	1.926	1.959	1.992	2.023	2.054	2.083	2.111	2.139
24	2.5	23.40	2.5	1.213	1.893	1.928	1.961	1.994	2.025	2.055	2.084	2.112	2.139
24	5	22.80	5	1.228	1.895	1.930	1.963	1.996	2.027	2.056	2.085	2.113	2.140
24	7.5	22.20	7.5	1.242	1.898	1.932	1.965	1.997	2.028	2.058	2.087	2.114	2.141
24	10	21.60	10	1.257	1.900	1.935	1.968	1.999	2.030	2.059	2.088	2.115	2.142
24	12.5	21.00	12.5	1.273	1.903	1.937	1.970	2.001	2.032	2.061	2.089	2.116	2.142
24	15	20.40	15	1.289	1.906	1.940	1.972	2.003	2.034	2.063	2.090	2.117	2.143
26	0	26.00	0	1.220	1.897	1.932	1.966	1.999	2.030	2.060	2.090	2.118	2.145
26	2.5	25.35	2.5	1.234	1.900	1.934	1.968	2.000	2.032	2.062	2.091	2.119	2.146
26	5	24.70	5	1.248	1.902	1.937	1.970	2.002	2.033	2.063	2.092	2.119	2.146
26	7.5	24.05	7.5	1.262	1.905	1.939	1.972	2.004	2.035	2.064	2.093	2.120	2.147
26	10	23.40	10	1.277	1.907	1.941	1.974	2.006	2.036	2.066	2.094	2.121	2.148
26	12.5	22.75	12.5	1.293	1.910	1.944	1.977	2.008	2.038	2.067	2.095	2.122	2.149
26	15	22.10	15	1.308	1.913	1.947	1.979	2.010	2.040	2.069	2.097	2.124	2.149
28	0	28.00	0	1.240	1.904	1.939	1.973	2.006	2.037	2.067	2.096	2.124	2.152
28	2.5	27.30	2.5	1.254	1.907	1.942	1.975	2.007	2.038	2.068	2.097	2.125	2.152
28	5	26.60	5	1.269	1.909	1.944	1.977	2.009	2.040	2.070	2.098	2.126	2.153
28	7.5	25.90	7.5	1.283	1.912	1.946	1.979	2.011	2.042	2.071	2.100	2.127	2.154
28	10	25.20	10	1.298	1.914	1.948	1.981	2.013	2.043	2.073	2.101	2.128	2.154
28	12.5	24.50	12.5	1.313	1.917	1.951	1.984	2.015	2.045	2.074	2.102	2.129	2.155
28	15	23.80	15	1.329	1.920	1.954	1.986	2.017	2.047	2.076	2.103	2.130	2.156
30	0	30.00	0	1.262	1.912	1.947	1.980	2.013	2.044	2.074	2.103	2.131	2.158
30	2.5	29.25	2.5	1.276	1.914	1.949	1.982	2.015	2.046	2.076	2.104	2.132	2.159
30	5	28.50	5	1.290	1.917	1.951	1.984	2.016	2.047	2.077	2.105	2.133	2.160
30	7.5	27.75	7.5	1.305	1.919	1.953	1.986	2.018	2.049	2.078	2.107	2.134	2.160
30	10	27.00	10	1.319	1.922	1.956	1.989	2.020	2.050	2.080	2.108	2.135	2.161
30	12.5	26.25	12.5	1.335	1.925	1.958	1.991	2.022	2.052	2.081	2.109	2.136	2.162
30	15	25.50	15	1.350	1.927	1.961	1.993	2.024	2.054	2.082	2.110	2.137	2.162
32	0	32.00	0	1.285	1.920	1.955	1.988	2.021	2.052	2.082	2.111	2.139	2.166
32	2.5	31.20	2.5	1.298	1.922	1.957	1.990	2.022	2.053	2.083	2.112	2.139	2.166
32	5	30.40	5	1.312	1.924	1.959	1.992	2.024	2.055	2.084	2.113	2.140	2.167
32	7.5	29.60	7.5	1.327	1.927	1.961	1.994	2.026	2.056	2.085	2.114	2.141	2.167
32	10	28.80	10	1.342	1.930	1.964	1.996	2.028	2.058	2.087	2.115	2.142	2.168
32	12.5	28.00	12.5	1.357	1.932	1.966	1.998	2.030	2.059	2.088	2.116	2.143	2.169
32	15	27.20	15	1.372	1.935	1.969	2.001	2.032	2.061	2.090	2.117	2.144	2.169
34	0	34.00	0	1.308	1.928	1.963	1.996	2.028	2.060	2.090	2.118	2.146	2.173
34	2.5	33.15	2.5	1.322	1.930	1.965	1.998	2.030	2.061	2.091	2.119	2.147	2.174
34	5	32.30	5	1.336	1.933	1.967	2.000	2.032	2.062	2.092	2.120	2.148	2.174
34	7.5	31.45	7.5	1.350	1.935	1.969	2.002	2.034	2.064	2.093	2.121	2.148	2.175
34	10	30.60	10	1.364	1.938	1.972	2.004	2.035	2.066	2.094	2.122	2.149	2.175
34	12.5	29.75	12.5	1.379	1.940	1.974	2.006	2.037	2.067	2.096	2.123	2.150	2.176
34	15	28.90	15	1.394	1.943	1.977	2.009	2.039	2.069	2.097	2.125	2.151	2.178
36	0	36.00	0	1.332	1.936	1.971	2.005	2.037	2.068	2.098	2.126	2.154	2.181
36	2.5	35.10	2.5	1.346	1.939	1.973	2.007	2.038	2.069	2.099	2.127	2.155	2.181
36	5	34.20	5	1.359	1.941	1.975	2.008	2.040	2.071	2.100	2.128	2.156	2.182
36	7.5	33.30	7.5	1.374	1.944	1.978	2.010	2.042	2.072	2.101	2.129	2.156	2.182
36	10	32.40	10	1.388	1.946	1.980	2.012	2.044	2.074	2.102	2.130	2.157	2.183
36	12.5	31.50	12.5	1.403	1.949	1.982	2.015	2.046	2.075	2.104	2.131	2.158	2.183
36	15	30.60	15	1.418	1.952	1.985	2.017	2.047	2.077	2.105	2.132	2.159	2.184
38	0	38.00	0	1.357	1.945	1.980	2.014	2.045	2.077	2.106	2.135	2.163	2.189
38	2.5	37.05	2.5	1.370	1.948	1.982	2.015	2.047	2.078	2.107	2.136	2.163	2.190
38	5	36.10	5	1.384	1.950	1.984	2.017	2.049	2.079	2.108	2.137	2.164	2.190
38	7.5	35.15	7.5	1.398	1.953	1.987	2.019	2.051	2.081	2.110	2.138	2.164	2.190
38	10	34.20	10	1.412	1.955	1.989	2.021	2.052	2.082	2.111	2.139	2.165	2.191
38	12.5	33.25	12.5	1.427	1.958	1.991	2.023	2.054	2.084	2.112	2.139	2.166	2.191
38	15	32.30	15	1.442	1.961	1.994	2.025	2.056	2.085	2.113	2.140	2.167	2.192
40	0	40.00	0	1.383	1.955	1.990	2.023	2.055	2.086	2.115	2.144	2.171	2.198
40	2.5	39.00	2.5	1.396	1.957	1.992	2.025	2.056	2.087	2.116	2.145	2.172	2.198
40	5	38.00	5	1.410	1.960	1.994	2.026	2.058	2.088	2.117	2.145	2.172	2.199
40	7.5	37.00	7.5	1.424	1.962	1.996	2.028	2.060	2.090	2.118	2.146	2.173	2.199
40	10	36.00	10	1.438	1.965	1.998	2.030	2.061	2.091	2.120	2.147	2.174	2.199
40	12.5	35.00	12.5	1.452	1.967	2.001	2.032	2.063	2.093	2.121	2.148	2.174	2.200
40	15	34.00	15	1.467	1.970	2.003	2.035	2.065	2.094	2.122	2.149	2.175	2.200

LINEAR REGRESSION OF INPUT SP. GR. vS OUTPUT SP. GR.

or Pozzolan Sp. Gr. of 2.6

Regression Output:

onstant		1.492450
td Err of Y Est		0.004864
Squared		0.984636
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.326833	
td Err of Coef.	0.003390	

or Pozzolan Sp. Gr. of 2.7

Regression Output:

onstant		1.532010
td Err of Y Est		0.005182
Squared		0.982161
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.322740	
td Err of Coef.	0.003612	

or Pozzolan Sp. Gr. of 2.8

Regression Output:

onstant		1.570475
td Err of Y Est		0.005498
Squared		0.979427
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.318465	
td Err of Coef.	0.003833	

or Pozzolan Sp. Gr. of 2.9

Regression Output:

onstant		1.607885
td Err of Y Est		0.005813
Squared		0.976425
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.314036	
td Err of Coef.	0.004052	

or Pozzolan Sp. Gr. of 3.0

Regression Output:

onstant		1.644278
td Err of Y Est		0.006125
Squared		0.973142
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.309479	
td Err of Coef.	0.004270	

or Pozzolan Sp. Gr. of 3.1

Regression Output:

onstant		1.6796882
td Err of Y Est		0.0064334
Squared		0.9695660
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.304816	
td Err of Coef.	0.004485	

or Pozzolan Sp. Gr. of 3.2

Regression Output:

onstant		1.7141518
td Err of Y Est		0.0067385
Squared		0.9656845
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.300068	
td Err of Coef.	0.004697	

or Pozzolan Sp. Gr. of 3.3

Regression Output:

onstant		1.7477021
td Err of Y Est		0.0070396
Squared		0.9614852
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.295251	
td Err of Coef.	0.004907	

or Pozzolan Sp. Gr. of 3.4

Regression Output:

onstant		1.780372
td Err of Y Est		0.007337
Squared		0.956955
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.290380	
td Err of Coef.	0.005114	

POZZOLAN SPECIFIC GRAVITY	X COEFF-ICIENT m	Y INTER-CEPT c
2.6	0.3268327	1.4924502
2.7	0.3227400	1.5320096
2.8	0.3184648	1.5704752
2.9	0.3140359	1.6078854
3.0	0.3094790	1.6442777
3.1	0.3048163	1.6796882
3.2	0.3000677	1.7141518
3.3	0.2952506	1.7477021
3.4	0.2903803	1.7803717

INEAR REGRESSION OF X COEFFICIENT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

onstant		0.446264
td Err of Y Est		0.000366
Squared		0.999254
o. of Observations		9
egrees of Freedom		7
Coefficient(s)	-0.045715	
td Err of Coef.	0.000472	

INEAR REGRESSION OF Y INTERCEPT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

onstant		0.562042
td Err of Y Est		0.003263
Squared		0.999041
o. of Observations		9
egrees of Freedom		7
Coefficient(s)	0.359653	
td Err of Coef.	0.004212	

TABLE G-3

OUTPU[illegible]DUCT SPECIFIC GRAVITIES FOR DIFFERENT TDS & TSS CONDITIONS FOR A WATER TO POZZOLAN RATIO O[illegible]

SPECIFIC GRAVITY OF POZZOLANS	2.600	2.70	2.80	2.90	3.00	3.10	3.20	3.30	3.40
SPECIFIC GRAVITY OF SALT	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251
SPECIFIC GRAVITY OF SILT	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23
W/P RATIO	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38

TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.
0	0	0.00	0	1.000	1.805	1.839	1.872	1.904	1.935	1.964	1.993	2.020	2.047
0	2.5	0.00	2.5	1.014	1.807	1.841	1.874	1.906	1.936	1.966	1.994	2.022	2.048
0	5	0.00	5	1.028	1.810	1.844	1.876	1.908	1.938	1.968	1.996	2.023	2.050
0	7.5	0.00	7.5	1.043	1.812	1.846	1.879	1.910	1.940	1.969	1.997	2.025	2.051
0	10	0.00	10	1.058	1.815	1.849	1.881	1.912	1.942	1.971	1.999	2.026	2.052
0	12.5	0.00	12.5	1.074	1.818	1.851	1.884	1.914	1.944	1.973	2.001	2.028	2.053
0	15	0.00	15	1.090	1.821	1.854	1.886	1.917	1.947	1.975	2.003	2.029	2.055
2	0	2.00	0	1.014	1.809	1.844	1.877	1.908	1.939	1.969	1.997	2.025	2.051
2	2.5	1.95	2.5	1.028	1.812	1.846	1.879	1.910	1.941	1.970	1.999	2.026	2.053
2	5	1.90	5	1.042	1.814	1.848	1.881	1.912	1.943	1.972	2.000	2.027	2.054
2	7.5	1.85	7.5	1.057	1.817	1.851	1.883	1.914	1.945	1.974	2.002	2.029	2.055
2	10	1.80	10	1.073	1.820	1.853	1.886	1.917	1.947	1.976	2.003	2.030	2.056
2	12.5	1.75	12.5	1.088	1.823	1.856	1.888	1.919	1.949	1.977	2.005	2.032	2.058
2	15	1.70	15	1.104	1.826	1.859	1.891	1.921	1.951	1.979	2.007	2.033	2.059
4	0	4.00	0	1.028	1.814	1.848	1.881	1.913	1.944	1.973	2.002	2.029	2.056
4	2.5	3.90	2.5	1.043	1.816	1.850	1.883	1.915	1.945	1.975	2.003	2.030	2.057
4	5	3.80	5	1.057	1.819	1.853	1.885	1.917	1.947	1.976	2.005	2.032	2.058
4	7.5	3.70	7.5	1.072	1.822	1.855	1.888	1.919	1.949	1.978	2.006	2.033	2.059
4	10	3.60	10	1.087	1.824	1.858	1.890	1.921	1.951	1.980	2.008	2.035	2.061
4	12.5	3.50	12.5	1.103	1.827	1.861	1.893	1.924	1.953	1.982	2.010	2.036	2.062
4	15	3.40	15	1.119	1.830	1.863	1.895	1.926	1.955	1.984	2.011	2.038	2.063
6	0	6.00	0	1.043	1.819	1.853	1.886	1.918	1.948	1.978	2.006	2.034	2.060
6	2.5	5.85	2.5	1.057	1.821	1.855	1.888	1.920	1.950	1.979	2.008	2.035	2.061
6	5	5.70	5	1.072	1.824	1.858	1.890	1.922	1.952	1.981	2.009	2.036	2.063
6	7.5	5.55	7.5	1.087	1.826	1.860	1.893	1.924	1.954	1.983	2.011	2.038	2.064
6	10	5.40	10	1.102	1.829	1.863	1.895	1.926	1.956	1.985	2.012	2.039	2.065
6	12.5	5.25	12.5	1.118	1.832	1.865	1.897	1.928	1.958	1.987	2.014	2.041	2.067
6	15	5.10	15	1.134	1.835	1.868	1.900	1.931	1.960	1.989	2.016	2.042	2.068
8	0	8.00	0	1.059	1.824	1.858	1.891	1.923	1.953	1.983	2.011	2.038	2.065
8	2.5	7.80	2.5	1.073	1.826	1.860	1.893	1.925	1.955	1.984	2.012	2.040	2.066
8	5	7.60	5	1.087	1.829	1.863	1.895	1.927	1.957	1.986	2.014	2.041	2.067
8	7.5	7.40	7.5	1.102	1.832	1.865	1.898	1.929	1.959	1.988	2.016	2.043	2.069
8	10	7.20	10	1.117	1.834	1.868	1.900	1.931	1.961	1.989	2.017	2.044	2.070
8	12.5	7.00	12.5	1.133	1.837	1.870	1.902	1.933	1.963	1.991	2.019	2.045	2.071
8	15	6.80	15	1.149	1.840	1.873	1.905	1.936	1.965	1.993	2.021	2.047	2.073
10	0	10.00	0	1.074	1.829	1.863	1.896	1.928	1.958	1.988	2.016	2.043	2.070
10	2.5	9.75	2.5	1.088	1.831	1.865	1.898	1.930	1.960	1.989	2.017	2.045	2.071
10	5	9.50	5	1.103	1.834	1.868	1.900	1.932	1.962	1.991	2.019	2.046	2.072
10	7.5	9.25	7.5	1.118	1.837	1.870	1.903	1.934	1.964	1.993	2.021	2.047	2.073
10	10	9.00	10	1.133	1.840	1.873	1.905	1.936	1.966	1.994	2.022	2.049	2.075
10	12.5	8.75	12.5	1.149	1.842	1.876	1.908	1.938	1.968	1.996	2.024	2.050	2.076
10	15	8.50	15	1.165	1.846	1.878	1.910	1.941	1.970	1.998	2.026	2.052	2.077
12	0	12.00	0	1.091	1.834	1.868	1.901	1.933	1.963	1.993	2.021	2.048	2.075
12	2.5	11.70	2.5	1.105	1.837	1.871	1.903	1.935	1.965	1.994	2.023	2.050	2.076
12	5	11.40	5	1.119	1.839	1.873	1.906	1.937	1.967	1.996	2.024	2.051	2.077
12	7.5	11.10	7.5	1.134	1.842	1.876	1.908	1.939	1.969	1.998	2.026	2.052	2.078
12	10	10.80	10	1.149	1.845	1.878	1.910	1.941	1.971	2.000	2.027	2.054	2.080
12	12.5	10.50	12.5	1.165	1.848	1.881	1.913	1.944	1.973	2.002	2.029	2.055	2.081
12	15	10.20	15	1.181	1.851	1.884	1.916	1.946	1.975	2.004	2.031	2.057	2.082
14	0	14.00	0	1.107	1.840	1.874	1.907	1.938	1.969	1.998	2.026	2.054	2.080
14	2.5	13.65	2.5	1.121	1.842	1.876	1.909	1.940	1.971	2.000	2.028	2.055	2.081
14	5	13.30	5	1.136	1.845	1.879	1.911	1.942	1.972	2.001	2.029	2.056	2.082
14	7.5	12.95	7.5	1.151	1.848	1.881	1.914	1.945	1.974	2.003	2.031	2.058	2.084
14	10	12.60	10	1.166	1.851	1.884	1.916	1.947	1.976	2.005	2.033	2.059	2.085
14	12.5	12.25	12.5	1.182	1.854	1.887	1.918	1.949	1.979	2.007	2.034	2.061	2.086
14	15	11.90	15	1.198	1.857	1.889	1.921	1.951	1.981	2.009	2.036	2.062	2.087
16	0	16.00	0	1.125	1.846	1.880	1.913	1.944	1.974	2.004	2.032	2.059	2.086
16	2.5	15.60	2.5	1.139	1.848	1.882	1.915	1.946	1.976	2.005	2.033	2.061	2.087
16	5	15.20	5	1.153	1.851	1.885	1.917	1.948	1.978	2.007	2.035	2.062	2.088
16	7.5	14.80	7.5	1.168	1.854	1.887	1.919	1.950	1.980	2.009	2.036	2.063	2.089
16	10	14.40	10	1.183	1.856	1.890	1.922	1.952	1.982	2.011	2.038	2.065	2.090
16	12.5	14.00	12.5	1.199	1.859	1.892	1.924	1.955	1.984	2.012	2.040	2.066	2.091
16	15	13.60	15	1.215	1.862	1.895	1.927	1.957	1.986	2.014	2.041	2.068	2.093
18	0	18.00	0	1.142	1.852	1.886	1.918	1.950	1.980	2.010	2.038	2.065	2.091
18	2.5	17.55	2.5	1.156	1.854	1.888	1.921	1.952	1.982	2.011	2.039	2.066	2.092
18	5	17.10	5	1.171	1.857	1.891	1.923	1.954	1.984	2.013	2.041	2.067	2.093
18	7.5	16.65	7.5	1.186	1.860	1.893	1.925	1.956	1.986	2.015	2.042	2.069	2.095
18	10	16.20	10	1.201	1.863	1.896	1.928	1.959	1.988	2.016	2.044	2.070	2.096
18	12.5	15.75	12.5	1.217	1.865	1.898	1.930	1.961	1.990	2.018	2.045	2.072	2.097
18	15	15.30	15	1.233	1.869	1.901	1.933	1.963	1.992	2.020	2.047	2.073	2.098
20	0	20.00	0	1.161	1.858	1.892	1.925	1.956	1.986	2.016	2.044	2.071	2.097
20	2.5	19.50	2.5	1.175	1.861	1.894	1.927	1.958	1.988	2.017	2.045	2.072	2.098
20	5	19.00	5	1.189	1.863	1.897	1.929	1.960	1.990	2.019	2.047	2.073	2.099
20	7.5	18.50	7.5	1.204	1.866	1.899	1.931	1.962	1.992	2.021	2.048	2.075	2.100
20	10	18.00	10	1.219	1.869	1.902	1.934	1.964	1.994	2.022	2.050	2.076	2.101
20	12.5	17.50	12.5	1.235	1.872	1.905	1.936	1.967	1.996	2.024	2.051	2.077	2.103
20	15	17.00	15	1.251	1.875	1.908	1.939	1.969	1.998	2.026	2.053	2.079	2.104
22	0	22.00	0	1.180	1.865	1.899	1.931	1.963	1.993	2.022	2.050	2.077	2.103
22	2.5	21.45	2.5	1.194	1.867	1.901	1.933	1.964	1.995	2.023	2.051	2.078	2.104
22	5	20.90	5	1.208	1.870	1.903	1.936	1.967	1.996	2.025	2.053	2.079	2.105
22	7.5	20.35	7.5	1.223	1.873	1.906	1.938	1.969	1.998	2.027	2.054	2.081	2.106
22	10	19.80	10	1.238	1.875	1.908	1.940	1.971	2.000	2.029	2.056	2.082	2.107
22	12.5	19.25	12.5	1.253	1.878	1.911	1.943	1.973	2.002	2.030	2.057	2.083	2.109
22	15	18.70	15	1.269	1.881	1.914	1.945	1.975	2.004	2.032	2.059	2.085	2.110
24	0	24.00	0	1.199	1.871	1.905	1.938	1.969	1.999	2.028	2.056	2.084	2.110
24	2.5	23.40	2.5	1.213	1.874	1.908	1.940	1.971	2.001	2.030	2.058	2.085	2.111
24	5	22.80	5	1.228	1.877	1.910	1.942	1.973	2.003	2.032	2.059	2.086	2.112
24	7.5	22.20	7.5	1.242	1.879	1.913	1.945	1.975	2.005	2.033	2.061	2.087	2.113
24	10	21.60	10	1.257	1.882	1.915	1.947	1.977	2.007	2.035	2.062	2.088	2.114
24	12.5	21.00	12.5	1.273	1.885	1.918	1.949	1.980	2.009	2.037	2.064	2.090	2.115
24	15	20.40	15	1.289	1.888	1.921	1.952	1.982	2.011	2.039	2.065	2.091	2.116
26	0	26.00	0	1.220	1.879	1.912	1.945	1.976	2.006	2.035	2.063	2.090	2.116
26	2.5	25.35	2.5	1.234	1.881	1.915	1.947	1.978	2.008	2.037	2.065	2.091	2.117
26	5	24.70	5	1.248	1.884	1.917	1.949	1.980	2.010	2.038	2.066	2.093	2.118
26	7.5	24.05	7.5	1.262	1.887	1.920	1.952	1.982	2.012	2.040	2.067	2.094	2.119
26	10	23.40	10	1.277	1.889	1.922	1.954	1.984	2.014	2.042	2.069	2.095	2.120
26	12.5	22.75	12.5	1.293	1.892	1.925	1.956	1.987	2.016	2.044	2.070	2.096	2.121
26	15	22.10	15	1.308	1.895	1.928	1.959	1.989	2.018	2.045	2.072	2.098	2.122
28	0	28.00	0	1.240	1.886	1.920	1.952	1.983	2.013	2.042	2.070	2.097	2.123
28	2.5	27.30	2.5	1.254	1.889	1.922	1.954	1.985	2.015	2.044	2.072	2.098	2.124
28	5	26.60	5	1.269	1.891	1.925	1.957	1.987	2.017	2.045	2.073	2.099	2.125
28	7.5	25.90	7.5	1.283	1.894	1.927	1.959	1.989	2.019	2.047	2.074	2.101	2.126
28	10	25.20	10	1.298	1.897	1.930	1.961	1.992	2.021	2.049	2.076	2.102	2.127
28	12.5	24.50	12.5	1.313	1.900	1.932	1.964	1.994	2.023	2.050	2.077	2.103	2.128
28	15	23.80	15	1.329	1.903	1.935	1.966	1.996	2.025	2.052	2.079	2.104	2.129
30	0	30.00	0	1.262	1.894	1.927	1.960	1.991	2.021	2.050	2.078	2.104	2.130
30	2.5	29.25	2.5	1.276	1.896	1.930	1.962	1.993	2.023	2.051	2.079	2.106	2.131
30	5	28.50	5	1.290	1.899	1.932	1.964	1.995	2.024	2.053	2.080	2.107	2.132
30	7.5	27.75	7.5	1.305	1.902	1.935	1.966	1.997	2.026	2.054	2.082	2.108	2.133
30	10	27.00	10	1.319	1.905	1.937	1.969	1.999	2.028	2.056	2.083	2.109	2.134
30	12.5	26.25	12.5	1.335	1.908	1.940	1.971	2.001	2.030	2.058	2.084	2.110	2.135
30	15	25.50	15	1.350	1.911	1.943	1.974	2.004	2.032	2.060	2.086	2.111	2.136
32	0	32.00	0	1.285	1.902	1.936	1.968	1.999	2.029	2.058	2.085	2.112	2.138
32	2.5	31.20	2.5	1.298	1.904	1.938	1.970	2.001	2.030	2.059	2.087	2.113	2.139
32	5	30.40	5	1.312	1.907	1.940	1.972	2.003	2.032	2.061	2.088	2.114	2.140
32	7.5	29.60	7.5	1.327	1.910	1.943	1.974	2.005	2.034	2.062	2.089	2.115	2.140
32	10	28.80	10	1.342	1.913	1.945	1.977	2.007	2.036	2.064	2.091	2.116	2.141
32	12.5	28.00	12.5	1.357	1.916	1.948	1.979	2.009	2.038	2.065	2.092	2.118	2.142
32	15	27.20	15	1.372	1.919	1.951	1.982	2.011	2.040	2.067	2.093	2.119	2.143
34	0	34.00	0	1.308	1.910	1.944	1.976	2.007	2.037	2.066	2.093	2.120	2.146
34	2.5	33.15	2.5	1.322	1.913	1.946	1.978	2.009	2.039	2.067	2.095	2.121	2.147
34	5	32.30	5	1.336	1.916	1.949	1.980	2.011	2.040	2.069	2.096	2.122	2.147
34	7.5	31.45	7.5	1.350	1.918	1.951	1.983	2.013	2.042	2.070	2.097	2.123	2.148
34	10	30.60	10	1.364	1.921	1.954	1.985	2.015	2.044	2.072	2.098	2.124	2.149
34	12.5	29.75	12.5	1.379	1.924	1.956	1.987	2.017	2.046	2.073	2.100	2.125	2.150
34	15	28.90	15	1.394	1.927	1.959	1.990	2.019	2.048	2.075	2.101	2.126	2.151
36	0	36.00	0	1.332	1.919	1.953	1.985	2.016	2.046	2.074	2.102	2.128	2.154
36	2.5	35.10	2.5	1.346	1.922	1.955	1.987	2.018	2.047	2.076	2.103	2.129	2.155
36	5	34.20	5	1.359	1.924	1.958	1.989	2.020	2.049	2.077	2.104	2.130	2.156
36	7.5	33.30	7.5	1.374	1.927	1.960	1.991	2.022	2.051	2.079	2.105	2.131	2.156
36	10	32.40	10	1.388	1.930	1.963	1.994	2.024	2.052	2.080	2.107	2.132	2.157
36	12.5	31.50	12.5	1.403	1.933	1.965	1.996	2.026	2.054	2.082	2.108	2.133	2.158
36	15	30.60	15	1.418	1.936	1.968	1.999	2.028	2.056	2.083	2.109	2.134	2.159
38	0	38.00	0	1.357	1.929	1.962	1.994	2.025	2.055	2.083	2.111	2.137	2.163
38	2.5	37.05	2.5	1.370	1.931	1.964	1.996	2.027	2.056	2.085	2.112	2.138	2.163
38	5	36.10	5	1.384	1.934	1.967	1.998	2.029	2.058	2.086	2.113	2.139	2.164
38	7.5	35.15	7.5	1.398	1.937	1.969	2.001	2.031	2.060	2.087	2.114	2.140	2.165
38	10	34.20	10	1.412	1.939	1.972	2.003	2.033	2.061	2.089	2.115	2.141	2.165
38	12.5	33.25	12.5	1.427	1.942	1.974	2.005	2.035	2.063	2.090	2.117	2.142	2.166
38	15	32.30	15	1.442	1.945	1.977	2.008	2.037	2.065	2.092	2.118	2.143	2.167
40	0	40.00	0	1.383	1.939	1.972	2.004	2.035	2.064	2.093	2.120	2.146	2.172
40	2.5	39.00	2.5	1.396	1.941	1.974	2.006	2.036	2.066	2.094	2.121	2.147	2.172
40	5	38.00	5	1.410	1.944	1.976	2.008	2.038	2.067	2.095	2.122	2.148	2.173
40	7.5	37.00	7.5	1.424	1.946	1.979	2.010	2.040	2.069	2.097	2.123	2.149	2.174
40	10	36.00	10	1.438	1.949	1.981	2.012	2.042	2.071	2.098	2.124	2.150	2.174
40	12.5	35.00	12.5	1.452	1.952	1.984	2.015	2.044	2.072	2.099	2.126	2.151	2.175
40	15	34.00	15	1.467	1.955	1.987	2.017	2.046	2.074	2.101	2.127	2.152	2.175

LINEAR REGRESSION OF INPUT SP. GR. vS OUTPUT SP. GR.

or Pozzolan Sp. Gr. of 2.6

Regression Output:

onstant		1.456848
td Err of Y Est		0.004857
Squared		0.985887
lo. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.340769	
td Err of Coef.	0.003386	

or Pozzolan Sp. Gr. of 2.7

Regression Output:

onstant		1.494840
td Err of Y Est		0.005169
Squared		0.983683
lo. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.336887	
td Err of Coef.	0.003603	

or Pozzolan Sp. Gr. of 2.8

Regression Output:

onstant		1.531744
td Err of Y Est		0.005479
Squared		0.981264
lo. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.332833	
td Err of Coef.	0.003819	

or Pozzolan Sp. Gr. of 2.9

Regression Output:

onstant		1.567600
td Err of Y Est		0.005786
Squared		0.978622
lo. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.328635	
td Err of Coef.	0.004034	

or Pozzolan Sp. Gr. of 3.0

Regression Output:

onstant		1.602446
td Err of Y Est		0.006091
Squared		0.975750
lo. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.324317	
td Err of Coef.	0.004246	

or Pozzolan Sp. Gr. of 3.1

Regression Output:

onstant		1.6363218
td Err of Y Est		0.0063916
Squared		0.9726407
lo. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.319902	
td Err of Coef.	0.004456	

or Pozzolan Sp. Gr. of 3.2

Regression Output:

onstant		1.6692615
td Err of Y Est		0.0066985
Squared		0.9692856
lo. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.315407	
td Err of Coef.	0.004663	

or Pozzolan Sp. Gr. of 3.3

Regression Output:

onstant		1.7013001626065
td Err of Y Est		0.0069813568549905
Squared		0.96587752979418
lo. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.310851	
td Err of Coef.	0.004867	

or Pozzolan Sp. Gr. of 3.4

Regression Output:

onstant		1.732471
td Err of Y Est		0.007270
Squared		0.961809
lo. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.306248	
td Err of Coef.	0.005068	

POZZOLAN SPECIFIC GRAVITY	X COEFF-ICIENT m	Y INTER-CEPT c
2.6	0.3407684	1.4568481
2.7	0.3368871	1.4948399
2.8	0.3328331	1.5317436
2.9	0.3286349	1.5675996
3.0	0.3243171	1.6024465
3.1	0.3199016	1.6363218
3.2	0.3154074	1.6692615
3.3	0.3108512	1.7013002
3.4	0.3062479	1.7324711

LINEAR REGRESSION OF X COEFFICIENT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

onstant		0.453870
td Err of Y Est		0.000339
Squared		0.999284
lo. of Observations		9
egrees of Freedom		7
Coefficient(s)	-0.043296	
td Err of Coef.	0.000438	

LINEAR REGRESSION OF Y INTERCEPT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

onstant		0.566388
td Err of Y Est		0.003230
Squared		0.998974
lo. of Observations		9
egrees of Freedom		7
Coefficient(s)	0.344272	
td Err of Coef.	0.004169	

TABLE G-4

O[illegible] PRODUCT SPECIFIC GRAVITIES FOR DIFFERENT TDS & TSS CONDITIONS FOR A WATER TO POZZOLAN RAT[illegible]0.40

SPECIFIC GRAVITY OF POZZOLANS					2.600	2.70	2.80	2.90	3.00	3.10	3.20	3.30	3.40
SPECIFIC GRAVITY OF SALT					3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251
SPECIFIC GRAVITY OF SILT					2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23
W/P RATIO					0.4	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40

TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.
0	0	0.00	0	1.000	1.784	1.817	1.849	1.880	1.909	1.938	1.965	1.991	2.017
0	2.5	0.00	2.5	1.014	1.787	1.820	1.851	1.882	1.911	1.939	1.967	1.993	2.018
0	5	0.00	5	1.028	1.790	1.822	1.854	1.884	1.913	1.941	1.968	1.995	2.020
0	7.5	0.00	7.5	1.043	1.792	1.825	1.856	1.886	1.915	1.943	1.970	1.996	2.021
0	10	0.00	10	1.058	1.795	1.828	1.859	1.889	1.918	1.945	1.972	1.998	2.023
0	12.5	0.00	12.5	1.074	1.798	1.831	1.862	1.891	1.920	1.948	1.974	2.000	2.025
0	15	0.00	15	1.090	1.802	1.834	1.864	1.894	1.922	1.950	1.976	2.002	2.026
2	0	2.00	0	1.014	1.789	1.822	1.854	1.884	1.914	1.942	1.969	1.996	2.021
2	2.5	1.95	2.5	1.028	1.792	1.824	1.856	1.886	1.916	1.944	1.971	1.997	2.023
2	5	1.90	5	1.042	1.794	1.827	1.858	1.889	1.918	1.946	1.973	1.999	2.024
2	7.5	1.85	7.5	1.057	1.797	1.830	1.861	1.891	1.920	1.948	1.975	2.001	2.026
2	10	1.80	10	1.073	1.800	1.832	1.864	1.893	1.922	1.950	1.977	2.002	2.027
2	12.5	1.75	12.5	1.088	1.803	1.835	1.866	1.896	1.925	1.952	1.979	2.004	2.029
2	15	1.70	15	1.104	1.806	1.838	1.869	1.899	1.927	1.954	1.981	2.006	2.031
4	0	4.00	0	1.028	1.794	1.827	1.858	1.889	1.918	1.947	1.974	2.000	2.026
4	2.5	3.90	2.5	1.043	1.796	1.829	1.861	1.891	1.920	1.949	1.976	2.002	2.027
4	5	3.80	5	1.057	1.799	1.832	1.863	1.893	1.923	1.951	1.978	2.004	2.029
4	7.5	3.70	7.5	1.072	1.802	1.835	1.866	1.896	1.925	1.953	1.979	2.005	2.030
4	10	3.60	10	1.087	1.805	1.837	1.868	1.898	1.927	1.955	1.981	2.007	2.032
4	12.5	3.50	12.5	1.103	1.808	1.840	1.871	1.901	1.929	1.957	1.983	2.009	2.033
4	15	3.40	15	1.119	1.811	1.843	1.874	1.903	1.932	1.959	1.985	2.011	2.035
6	0	6.00	0	1.043	1.799	1.832	1.863	1.894	1.923	1.952	1.979	2.005	2.031
6	2.5	5.85	2.5	1.057	1.801	1.834	1.866	1.896	1.925	1.953	1.981	2.007	2.032
6	5	5.70	5	1.072	1.804	1.837	1.868	1.898	1.927	1.955	1.982	2.008	2.034
6	7.5	5.55	7.5	1.087	1.807	1.840	1.871	1.901	1.930	1.957	1.984	2.010	2.035
6	10	5.40	10	1.102	1.810	1.842	1.873	1.903	1.932	1.959	1.986	2.012	2.037
6	12.5	5.25	12.5	1.118	1.813	1.845	1.876	1.906	1.934	1.962	1.988	2.014	2.038
6	15	5.10	15	1.134	1.816	1.848	1.879	1.908	1.937	1.964	1.990	2.015	2.040
8	0	8.00	0	1.059	1.804	1.837	1.869	1.899	1.928	1.957	1.984	2.010	2.036
8	2.5	7.80	2.5	1.073	1.807	1.839	1.871	1.901	1.930	1.959	1.986	2.012	2.037
8	5	7.60	5	1.087	1.809	1.842	1.873	1.903	1.932	1.960	1.987	2.013	2.038
8	7.5	7.40	7.5	1.102	1.812	1.845	1.876	1.906	1.935	1.962	1.989	2.015	2.040
8	10	7.20	10	1.117	1.815	1.848	1.879	1.908	1.937	1.965	1.991	2.017	2.041
8	12.5	7.00	12.5	1.133	1.818	1.850	1.881	1.911	1.939	1.967	1.993	2.019	2.043
8	15	6.80	15	1.149	1.822	1.854	1.884	1.913	1.942	1.969	1.995	2.020	2.045
10	0	10.00	0	1.074	1.809	1.842	1.874	1.904	1.934	1.962	1.989	2.015	2.041
10	2.5	9.75	2.5	1.088	1.812	1.845	1.876	1.907	1.936	1.964	1.991	2.017	2.042
10	5	9.50	5	1.103	1.815	1.847	1.879	1.909	1.938	1.966	1.993	2.019	2.044
10	7.5	9.25	7.5	1.118	1.818	1.850	1.881	1.911	1.940	1.968	1.994	2.020	2.045
10	10	9.00	10	1.133	1.821	1.853	1.884	1.914	1.942	1.970	1.996	2.022	2.047
10	12.5	8.75	12.5	1.149	1.824	1.856	1.887	1.916	1.945	1.972	1.998	2.024	2.048
10	15	8.50	15	1.165	1.827	1.859	1.889	1.919	1.947	1.974	2.000	2.025	2.050
12	0	12.00	0	1.091	1.815	1.848	1.879	1.910	1.939	1.967	1.995	2.021	2.046
12	2.5	11.70	2.5	1.105	1.818	1.850	1.882	1.912	1.941	1.969	1.996	2.022	2.047
12	5	11.40	5	1.119	1.821	1.853	1.884	1.914	1.943	1.971	1.998	2.024	2.049
12	7.5	11.10	7.5	1.134	1.823	1.856	1.887	1.917	1.945	1.973	2.000	2.025	2.050
12	10	10.80	10	1.149	1.826	1.859	1.889	1.919	1.948	1.975	2.002	2.027	2.052
12	12.5	10.50	12.5	1.165	1.830	1.861	1.892	1.922	1.950	1.977	2.004	2.029	2.053
12	15	10.20	15	1.181	1.833	1.865	1.895	1.924	1.952	1.979	2.006	2.031	2.055
14	0	14.00	0	1.107	1.821	1.854	1.885	1.916	1.945	1.973	2.000	2.026	2.052
14	2.5	13.65	2.5	1.121	1.824	1.856	1.888	1.918	1.947	1.975	2.002	2.028	2.053
14	5	13.30	5	1.136	1.826	1.859	1.890	1.920	1.949	1.977	2.003	2.029	2.054
14	7.5	12.95	7.5	1.151	1.829	1.862	1.893	1.922	1.951	1.979	2.005	2.031	2.056
14	10	12.60	10	1.166	1.832	1.864	1.895	1.925	1.953	1.981	2.007	2.033	2.057
14	12.5	12.25	12.5	1.182	1.835	1.867	1.898	1.927	1.956	1.983	2.009	2.034	2.059
14	15	11.90	15	1.198	1.839	1.870	1.901	1.930	1.958	1.985	2.011	2.036	2.060
16	0	16.00	0	1.125	1.827	1.860	1.891	1.921	1.951	1.979	2.006	2.032	2.057
16	2.5	15.60	2.5	1.139	1.830	1.862	1.894	1.924	1.953	1.981	2.008	2.033	2.059
16	5	15.20	5	1.153	1.832	1.865	1.896	1.926	1.955	1.982	2.009	2.035	2.060
16	7.5	14.80	7.5	1.168	1.835	1.868	1.899	1.928	1.957	1.984	2.011	2.037	2.061
16	10	14.40	10	1.183	1.838	1.870	1.901	1.931	1.959	1.987	2.013	2.038	2.063
16	12.5	14.00	12.5	1.199	1.842	1.873	1.904	1.933	1.961	1.989	2.015	2.040	2.064
16	15	13.60	15	1.215	1.845	1.876	1.907	1.936	1.964	1.991	2.017	2.042	2.066
18	0	18.00	0	1.142	1.833	1.866	1.897	1.928	1.957	1.985	2.012	2.038	2.063
18	2.5	17.55	2.5	1.156	1.836	1.868	1.900	1.930	1.959	1.987	2.014	2.039	2.064
18	5	17.10	5	1.171	1.839	1.871	1.902	1.932	1.961	1.989	2.015	2.041	2.066
18	7.5	16.65	7.5	1.186	1.842	1.874	1.905	1.934	1.963	1.990	2.017	2.043	2.067
18	10	16.20	10	1.201	1.845	1.877	1.907	1.937	1.965	1.993	2.019	2.044	2.069
18	12.5	15.75	12.5	1.217	1.848	1.880	1.910	1.939	1.968	1.995	2.021	2.046	2.070
18	15	15.30	15	1.233	1.851	1.883	1.913	1.942	1.970	1.997	2.023	2.048	2.072
20	0	20.00	0	1.161	1.840	1.872	1.904	1.934	1.963	1.991	2.018	2.044	2.069
20	2.5	19.50	2.5	1.175	1.842	1.875	1.906	1.936	1.965	1.993	2.020	2.046	2.071
20	5	19.00	5	1.189	1.845	1.878	1.909	1.938	1.967	1.995	2.021	2.047	2.072
20	7.5	18.50	7.5	1.204	1.848	1.880	1.911	1.941	1.969	1.997	2.023	2.049	2.073
20	10	18.00	10	1.219	1.851	1.883	1.914	1.943	1.972	1.999	2.025	2.050	2.075
20	12.5	17.50	12.5	1.235	1.854	1.886	1.917	1.946	1.974	2.001	2.027	2.052	2.076
20	15	17.00	15	1.251	1.858	1.889	1.919	1.948	1.976	2.003	2.029	2.054	2.078
22	0	22.00	0	1.180	1.846	1.879	1.910	1.941	1.970	1.998	2.025	2.051	2.076
22	2.5	21.45	2.5	1.194	1.849	1.882	1.913	1.943	1.972	1.999	2.026	2.052	2.077
22	5	20.90	5	1.208	1.852	1.884	1.915	1.945	1.974	2.001	2.028	2.054	2.078
22	7.5	20.35	7.5	1.223	1.855	1.887	1.918	1.947	1.976	2.003	2.030	2.055	2.080
22	10	19.80	10	1.238	1.858	1.890	1.920	1.950	1.978	2.005	2.031	2.057	2.081
22	12.5	19.25	12.5	1.253	1.861	1.893	1.923	1.952	1.980	2.007	2.033	2.058	2.082
22	15	18.70	15	1.269	1.865	1.896	1.926	1.955	1.983	2.010	2.035	2.060	2.084
24	0	24.00	0	1.199	1.854	1.886	1.917	1.948	1.977	2.005	2.031	2.057	2.082
24	2.5	23.40	2.5	1.213	1.856	1.889	1.920	1.950	1.979	2.006	2.033	2.059	2.084
24	5	22.80	5	1.228	1.859	1.891	1.922	1.952	1.981	2.008	2.035	2.060	2.085
24	7.5	22.20	7.5	1.242	1.862	1.894	1.925	1.954	1.983	2.010	2.036	2.062	2.086
24	10	21.60	10	1.257	1.865	1.897	1.927	1.957	1.985	2.012	2.038	2.063	2.087
24	12.5	21.00	12.5	1.273	1.868	1.900	1.930	1.959	1.987	2.014	2.040	2.065	2.089
24	15	20.40	15	1.289	1.872	1.903	1.933	1.962	1.990	2.016	2.042	2.067	2.090
26	0	26.00	0	1.220	1.861	1.893	1.925	1.955	1.984	2.012	2.038	2.064	2.089
26	2.5	25.35	2.5	1.234	1.864	1.896	1.927	1.957	1.986	2.013	2.040	2.066	2.090
26	5	24.70	5	1.248	1.867	1.899	1.930	1.959	1.988	2.015	2.042	2.067	2.092
26	7.5	24.05	7.5	1.262	1.869	1.901	1.932	1.962	1.990	2.017	2.043	2.069	2.093
26	10	23.40	10	1.277	1.873	1.904	1.935	1.964	1.992	2.019	2.045	2.070	2.094
26	12.5	22.75	12.5	1.293	1.876	1.907	1.937	1.966	1.994	2.021	2.047	2.072	2.096
26	15	22.10	15	1.308	1.879	1.910	1.940	1.969	1.997	2.023	2.049	2.073	2.097
28	0	28.00	0	1.240	1.869	1.901	1.932	1.962	1.991	2.019	2.046	2.072	2.097
28	2.5	27.30	2.5	1.254	1.871	1.904	1.935	1.965	1.993	2.021	2.047	2.073	2.098
28	5	26.60	5	1.269	1.874	1.906	1.937	1.967	1.995	2.023	2.049	2.074	2.099
28	7.5	25.90	7.5	1.283	1.877	1.909	1.940	1.969	1.997	2.024	2.051	2.076	2.100
28	10	25.20	10	1.298	1.880	1.912	1.942	1.971	1.999	2.026	2.052	2.077	2.101
28	12.5	24.50	12.5	1.313	1.883	1.915	1.945	1.974	2.002	2.028	2.054	2.079	2.103
28	15	23.80	15	1.329	1.887	1.918	1.948	1.976	2.004	2.030	2.056	2.080	2.104
30	0	30.00	0	1.262	1.877	1.909	1.940	1.970	1.999	2.027	2.054	2.079	2.104
30	2.5	29.25	2.5	1.276	1.879	1.912	1.943	1.972	2.001	2.029	2.055	2.081	2.105
30	5	28.50	5	1.290	1.882	1.914	1.945	1.975	2.003	2.030	2.057	2.082	2.106
30	7.5	27.75	7.5	1.305	1.885	1.917	1.948	1.977	2.005	2.032	2.058	2.083	2.107
30	10	27.00	10	1.319	1.888	1.920	1.950	1.979	2.007	2.034	2.060	2.085	2.109
30	12.5	26.25	12.5	1.335	1.891	1.923	1.953	1.982	2.009	2.036	2.062	2.086	2.110
30	15	25.50	15	1.350	1.895	1.926	1.956	1.984	2.012	2.038	2.063	2.088	2.111
32	0	32.00	0	1.285	1.885	1.918	1.949	1.979	2.007	2.035	2.062	2.087	2.112
32	2.5	31.20	2.5	1.298	1.888	1.920	1.951	1.981	2.009	2.037	2.063	2.088	2.113
32	5	30.40	5	1.312	1.891	1.923	1.953	1.983	2.011	2.038	2.065	2.090	2.114
32	7.5	29.60	7.5	1.327	1.894	1.925	1.956	1.985	2.013	2.040	2.066	2.091	2.115
32	10	28.80	10	1.342	1.897	1.928	1.958	1.987	2.015	2.042	2.068	2.093	2.116
32	12.5	28.00	12.5	1.357	1.900	1.931	1.961	1.990	2.017	2.044	2.069	2.094	2.118
32	15	27.20	15	1.372	1.903	1.934	1.964	1.992	2.020	2.046	2.071	2.095	2.119
34	0	34.00	0	1.308	1.894	1.926	1.957	1.987	2.016	2.043	2.070	2.096	2.120
34	2.5	33.15	2.5	1.322	1.897	1.929	1.960	1.989	2.018	2.045	2.071	2.097	2.121
34	5	32.30	5	1.336	1.900	1.931	1.962	1.991	2.020	2.047	2.073	2.098	2.122
34	7.5	31.45	7.5	1.350	1.902	1.934	1.964	1.994	2.022	2.049	2.074	2.099	2.123
34	10	30.60	10	1.364	1.905	1.937	1.967	1.996	2.024	2.050	2.076	2.101	2.124
34	12.5	29.75	12.5	1.379	1.909	1.940	1.970	1.998	2.026	2.052	2.078	2.102	2.126
34	15	28.90	15	1.394	1.912	1.943	1.972	2.001	2.028	2.054	2.079	2.103	2.127
36	0	36.00	0	1.332	1.903	1.935	1.966	1.996	2.025	2.052	2.079	2.104	2.129
36	2.5	35.10	2.5	1.346	1.906	1.938	1.969	1.998	2.027	2.054	2.080	2.105	2.130
36	5	34.20	5	1.359	1.909	1.941	1.971	2.000	2.029	2.056	2.082	2.107	2.131
36	7.5	33.30	7.5	1.374	1.912	1.943	1.974	2.003	2.030	2.057	2.083	2.108	2.132
36	10	32.40	10	1.388	1.915	1.946	1.976	2.005	2.032	2.059	2.085	2.109	2.133
36	12.5	31.50	12.5	1.403	1.918	1.949	1.979	2.007	2.035	2.061	2.086	2.110	2.134
36	15	30.60	15	1.418	1.921	1.952	1.981	2.010	2.037	2.063	2.088	2.112	2.135
38	0	38.00	0	1.357	1.913	1.945	1.976	2.006	2.034	2.062	2.088	2.113	2.138
38	2.5	37.05	2.5	1.370	1.916	1.948	1.978	2.008	2.036	2.063	2.089	2.115	2.139
38	5	36.10	5	1.384	1.918	1.950	1.981	2.010	2.038	2.065	2.091	2.116	2.140
38	7.5	35.15	7.5	1.398	1.921	1.953	1.983	2.012	2.040	2.066	2.092	2.117	2.141
38	10	34.20	10	1.412	1.924	1.956	1.985	2.014	2.042	2.068	2.094	2.118	2.142
38	12.5	33.25	12.5	1.427	1.927	1.958	1.988	2.016	2.044	2.070	2.095	2.119	2.143
38	15	32.30	15	1.442	1.931	1.961	1.991	2.019	2.046	2.072	2.097	2.121	2.144
40	0	40.00	0	1.383	1.923	1.955	1.986	2.016	2.044	2.071	2.098	2.123	2.147
40	2.5	39.00	2.5	1.396	1.926	1.958	1.988	2.018	2.046	2.073	2.099	2.124	2.148
40	5	38.00	5	1.410	1.929	1.960	1.991	2.020	2.048	2.074	2.100	2.125	2.149
40	7.5	37.00	7.5	1.424	1.931	1.963	1.993	2.022	2.049	2.076	2.102	2.126	2.150
40	10	36.00	10	1.438	1.934	1.966	1.995	2.024	2.051	2.078	2.103	2.127	2.151
40	12.5	35.00	12.5	1.452	1.938	1.968	1.998	2.026	2.053	2.079	2.104	2.129	2.152
40	15	34.00	15	1.467	1.941	1.971	2.001	2.029	2.055	2.081	2.106	2.130	2.153

LINEAR REGRESSION OF INPUT SP. GR. vS OUTPUT SP. GR.

For Pozzolan Sp. Gr. of 2.6

Regression Output:

Constant		1.422863
Std Err of Y Est		0.004844
R Squared		0.985991
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.354202	
Std Err of Coef.	0.003377	

For Pozzolan Sp. Gr. of 2.7

Regression Output:

Constant		1.459386
Std Err of Y Est		0.005150
R Squared		0.985019
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.350524	
Std Err of Coef.	0.003590	

For Pozzolan Sp. Gr. of 2.8

Regression Output:

Constant		1.494829
Std Err of Y Est		0.005453
R Squared		0.982865
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.346683	
Std Err of Coef.	0.003801	

For Pozzolan Sp. Gr. of 2.9

Regression Output:

Constant		1.529233
Std Err of Y Est		0.005754
R Squared		0.980526
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.342705	
Std Err of Coef.	0.004011	

For Pozzolan Sp. Gr. of 3.0

Regression Output:

Constant		1.562638
Std Err of Y Est		0.006051
R Squared		0.977997
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.338616	
Std Err of Coef.	0.004218	

For Pozzolan Sp. Gr. of 3.1

Regression Output:

Constant		1.5950830
Std Err of Y Est		0.0063438
R Squared		0.9752730
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.334436	
Std Err of Coef.	0.004422	

For Pozzolan Sp. Gr. of 3.2

Regression Output:

Constant		1.6266049
Std Err of Y Est		0.0066329
R Squared		0.9723504
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.330184	
Std Err of Coef.	0.004624	

For Pozzolan Sp. Gr. of 3.3

Regression Output:

Constant		1.6572391
Std Err of Y Est		0.0069176
R Squared		0.9692244
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.325876	
Std Err of Coef.	0.004822	

For Pozzolan Sp. Gr. of 3.4

Regression Output:

Constant		1.687019
Std Err of Y Est		0.007198
R Squared		0.965891
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.321525	
Std Err of Coef.	0.005018	

POZZOLAN SPECIFIC GRAVITY	X COEFF-ICIENT m	Y INTER-CEPT c
2.6	0.3542015	1.4228631
2.7	0.3505239	1.4593861
2.8	0.3466826	1.4948288
2.9	0.3427054	1.5292327
3.0	0.3386163	1.5626380
3.1	0.3344364	1.5950830
3.2	0.3301842	1.6266049
3.3	0.3258757	1.6572391
3.4	0.3215251	1.6870194

LINEAR REGRESSION OF X COEFFICIENT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant		0.461264
Std Err of Y Est		0.000316
R Squared		0.999306
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	-0.040986	
Std Err of Coef.	0.000408	

LINEAR REGRESSION OF Y INTERCEPT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant		0.569639
Std Err of Y Est		0.003192
R Squared		0.998909
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	0.329931	
Std Err of Coef.	0.004121	

TABLE G-5

OUT[illegible]DUCT SPECIFIC GRAVITIES FOR DIFFERENT TDS & TSS CONDITIONS FOR A WATER TO POZZOLAN RATIO [illegible]2

PECIFIC GRAVITY OF POZZOLANS	2.600	2.70	2.80	2.90	3.00	3.10	3.20	3.30	3.40
PECIFIC GRAVITY OF SALT	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251
PECIFIC GRAVITY OF SILT	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23
W/P RATIO	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42

TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.
0	0	0.00	0	1.000	1.765	1.797	1.827	1.857	1.885	1.912	1.939	1.964	1.988
0	2.5	0.00	2.5	1.014	1.768	1.799	1.830	1.859	1.887	1.914	1.940	1.966	1.990
0	5	0.00	5	1.028	1.770	1.802	1.832	1.861	1.889	1.916	1.942	1.968	1.992
0	7.5	0.00	7.5	1.043	1.773	1.805	1.835	1.864	1.892	1.919	1.945	1.969	1.994
0	10	0.00	10	1.058	1.777	1.808	1.838	1.867	1.894	1.921	1.947	1.971	1.995
0	12.5	0.00	12.5	1.074	1.780	1.811	1.841	1.869	1.897	1.923	1.949	1.974	1.997
0	15	0.00	15	1.090	1.783	1.814	1.844	1.872	1.900	1.926	1.951	1.976	1.999
2	0	2.00	0	1.014	1.770	1.801	1.832	1.861	1.890	1.917	1.943	1.969	1.993
2	2.5	1.95	2.5	1.028	1.772	1.804	1.835	1.864	1.892	1.919	1.945	1.970	1.995
2	5	1.90	5	1.042	1.775	1.807	1.837	1.866	1.894	1.921	1.947	1.972	1.996
2	7.5	1.85	7.5	1.057	1.778	1.810	1.840	1.869	1.897	1.923	1.949	1.974	1.998
2	10	1.80	10	1.073	1.782	1.813	1.843	1.871	1.899	1.926	1.951	1.976	2.000
2	12.5	1.75	12.5	1.088	1.785	1.816	1.846	1.874	1.902	1.928	1.954	1.978	2.002
2	15	1.70	15	1.104	1.788	1.819	1.849	1.877	1.904	1.931	1.956	1.980	2.004
4	0	4.00	0	1.028	1.775	1.806	1.837	1.866	1.895	1.922	1.948	1.973	1.998
4	2.5	3.90	2.5	1.043	1.778	1.809	1.840	1.869	1.897	1.924	1.950	1.975	2.000
4	5	3.80	5	1.057	1.780	1.812	1.842	1.871	1.899	1.926	1.952	1.977	2.001
4	7.5	3.70	7.5	1.072	1.783	1.815	1.845	1.874	1.902	1.928	1.954	1.979	2.003
4	10	3.60	10	1.087	1.787	1.818	1.848	1.876	1.904	1.931	1.956	1.981	2.005
4	12.5	3.50	12.5	1.103	1.790	1.821	1.851	1.879	1.907	1.933	1.958	1.983	2.007
4	15	3.40	15	1.119	1.793	1.824	1.854	1.882	1.909	1.936	1.961	1.985	2.009
6	0	6.00	0	1.043	1.780	1.812	1.842	1.872	1.900	1.927	1.953	1.978	2.003
6	2.5	5.85	2.5	1.057	1.783	1.814	1.845	1.874	1.902	1.929	1.955	1.980	2.004
6	5	5.70	5	1.072	1.786	1.817	1.847	1.876	1.904	1.931	1.957	1.982	2.006
6	7.5	5.55	7.5	1.087	1.789	1.820	1.850	1.879	1.907	1.933	1.959	1.984	2.008
6	10	5.40	10	1.102	1.792	1.823	1.853	1.882	1.909	1.936	1.961	1.986	2.010
6	12.5	5.25	12.5	1.118	1.795	1.826	1.856	1.884	1.912	1.938	1.963	1.988	2.012
6	15	5.10	15	1.134	1.799	1.829	1.859	1.887	1.914	1.941	1.966	1.990	2.013
8	0	8.00	0	1.059	1.785	1.817	1.847	1.877	1.905	1.932	1.958	1.984	2.008
8	2.5	7.80	2.5	1.073	1.788	1.820	1.850	1.879	1.907	1.934	1.960	1.985	2.010
8	5	7.60	5	1.087	1.791	1.822	1.853	1.882	1.910	1.936	1.962	1.987	2.011
8	7.5	7.40	7.5	1.102	1.794	1.825	1.855	1.884	1.912	1.939	1.964	1.989	2.013
8	10	7.20	10	1.117	1.797	1.828	1.858	1.887	1.914	1.941	1.966	1.991	2.015
8	12.5	7.00	12.5	1.133	1.801	1.832	1.861	1.890	1.917	1.943	1.969	1.993	2.017
8	15	6.80	15	1.149	1.804	1.835	1.864	1.893	1.920	1.946	1.971	1.995	2.019
10	0	10.00	0	1.074	1.791	1.823	1.853	1.882	1.910	1.938	1.964	1.989	2.013
10	2.5	9.75	2.5	1.088	1.794	1.825	1.856	1.885	1.913	1.940	1.966	1.991	2.015
10	5	9.50	5	1.103	1.797	1.828	1.858	1.887	1.915	1.942	1.968	1.993	2.017
10	7.5	9.25	7.5	1.118	1.800	1.831	1.861	1.890	1.917	1.944	1.970	1.994	2.018
10	10	9.00	10	1.133	1.803	1.834	1.864	1.892	1.920	1.946	1.972	1.996	2.020
10	12.5	8.75	12.5	1.149	1.806	1.837	1.867	1.895	1.922	1.949	1.974	1.998	2.022
10	15	8.50	15	1.165	1.810	1.840	1.870	1.898	1.925	1.951	1.976	2.001	2.024
12	0	12.00	0	1.091	1.797	1.828	1.859	1.888	1.916	1.943	1.969	1.995	2.019
12	2.5	11.70	2.5	1.105	1.800	1.831	1.861	1.890	1.918	1.945	1.971	1.996	2.020
12	5	11.40	5	1.119	1.803	1.834	1.864	1.893	1.921	1.947	1.973	1.998	2.022
12	7.5	11.10	7.5	1.134	1.806	1.837	1.867	1.895	1.923	1.950	1.975	2.000	2.024
12	10	10.80	10	1.149	1.809	1.840	1.870	1.898	1.926	1.952	1.977	2.002	2.026
12	12.5	10.50	12.5	1.165	1.812	1.843	1.873	1.901	1.928	1.954	1.980	2.004	2.027
12	15	10.20	15	1.181	1.816	1.846	1.876	1.904	1.931	1.957	1.982	2.006	2.029
14	0	14.00	0	1.107	1.803	1.834	1.865	1.894	1.922	1.949	1.975	2.000	2.025
14	2.5	13.65	2.5	1.121	1.806	1.837	1.867	1.896	1.924	1.951	1.977	2.002	2.026
14	5	13.30	5	1.136	1.809	1.840	1.870	1.899	1.927	1.953	1.979	2.004	2.028
14	7.5	12.95	7.5	1.151	1.812	1.843	1.873	1.901	1.929	1.956	1.981	2.006	2.029
14	10	12.60	10	1.166	1.815	1.846	1.876	1.904	1.931	1.958	1.983	2.008	2.031
14	12.5	12.25	12.5	1.182	1.818	1.849	1.878	1.907	1.934	1.960	1.985	2.010	2.033
14	15	11.90	15	1.198	1.822	1.852	1.882	1.910	1.937	1.963	1.988	2.012	2.035
16	0	16.00	0	1.125	1.809	1.841	1.871	1.900	1.928	1.955	1.981	2.006	2.031
16	2.5	15.60	2.5	1.139	1.812	1.843	1.873	1.902	1.930	1.957	1.983	2.008	2.032
16	5	15.20	5	1.153	1.815	1.846	1.876	1.905	1.933	1.959	1.985	2.010	2.034
16	7.5	14.80	7.5	1.168	1.818	1.849	1.879	1.908	1.935	1.962	1.987	2.012	2.035
16	10	14.40	10	1.183	1.821	1.852	1.882	1.910	1.938	1.964	1.989	2.014	2.037
16	12.5	14.00	12.5	1.199	1.825	1.855	1.885	1.913	1.940	1.966	1.991	2.016	2.039
16	15	13.60	15	1.215	1.828	1.859	1.888	1.916	1.943	1.969	1.994	2.018	2.041
18	0	18.00	0	1.142	1.815	1.847	1.877	1.906	1.935	1.961	1.987	2.013	2.037
18	2.5	17.55	2.5	1.156	1.818	1.850	1.880	1.909	1.937	1.964	1.989	2.014	2.038
18	5	17.10	5	1.171	1.821	1.853	1.883	1.911	1.939	1.966	1.991	2.016	2.040
18	7.5	16.65	7.5	1.186	1.824	1.856	1.885	1.914	1.941	1.968	1.993	2.018	2.041
18	10	16.20	10	1.201	1.828	1.859	1.888	1.917	1.944	1.970	1.995	2.020	2.043
18	12.5	15.75	12.5	1.217	1.831	1.862	1.891	1.919	1.946	1.972	1.998	2.022	2.045
18	15	15.30	15	1.233	1.835	1.865	1.894	1.922	1.949	1.975	2.000	2.024	2.047
20	0	20.00	0	1.161	1.822	1.854	1.884	1.913	1.941	1.968	1.994	2.019	2.043
20	2.5	19.50	2.5	1.175	1.825	1.856	1.887	1.916	1.943	1.970	1.996	2.021	2.045
20	5	19.00	5	1.189	1.828	1.859	1.889	1.918	1.946	1.972	1.998	2.022	2.046
20	7.5	18.50	7.5	1.204	1.831	1.862	1.892	1.921	1.948	1.974	2.000	2.024	2.048
20	10	18.00	10	1.219	1.835	1.865	1.895	1.923	1.950	1.977	2.002	2.026	2.049
20	12.5	17.50	12.5	1.235	1.838	1.869	1.898	1.926	1.953	1.979	2.004	2.028	2.051
20	15	17.00	15	1.251	1.841	1.872	1.901	1.929	1.956	1.981	2.006	2.030	2.053
22	0	22.00	0	1.180	1.829	1.861	1.891	1.920	1.948	1.975	2.001	2.026	2.050
22	2.5	21.45	2.5	1.194	1.832	1.863	1.894	1.922	1.950	1.977	2.003	2.027	2.051
22	5	20.90	5	1.208	1.835	1.866	1.896	1.925	1.952	1.979	2.004	2.029	2.053
22	7.5	20.35	7.5	1.223	1.838	1.869	1.899	1.927	1.955	1.981	2.006	2.031	2.054
22	10	19.80	10	1.238	1.842	1.872	1.902	1.930	1.957	1.983	2.008	2.033	2.056
22	12.5	19.25	12.5	1.253	1.845	1.876	1.905	1.933	1.960	1.986	2.011	2.035	2.058
22	15	18.70	15	1.269	1.849	1.879	1.908	1.936	1.962	1.988	2.013	2.037	2.059
24	0	24.00	0	1.199	1.837	1.868	1.898	1.927	1.955	1.982	2.008	2.033	2.057
24	2.5	23.40	2.5	1.213	1.839	1.871	1.901	1.930	1.957	1.984	2.010	2.034	2.058
24	5	22.80	5	1.228	1.843	1.874	1.903	1.932	1.960	1.986	2.011	2.036	2.060
24	7.5	22.20	7.5	1.242	1.846	1.877	1.906	1.935	1.962	1.988	2.013	2.038	2.061
24	10	21.60	10	1.257	1.849	1.880	1.909	1.937	1.964	1.990	2.015	2.040	2.063
24	12.5	21.00	12.5	1.273	1.852	1.883	1.912	1.940	1.967	1.993	2.018	2.041	2.064
24	15	20.40	15	1.289	1.856	1.886	1.915	1.943	1.969	1.995	2.020	2.043	2.066
26	0	26.00	0	1.220	1.844	1.876	1.906	1.935	1.963	1.989	2.015	2.040	2.064
26	2.5	25.35	2.5	1.234	1.847	1.878	1.908	1.937	1.965	1.991	2.017	2.042	2.065
26	5	24.70	5	1.248	1.850	1.881	1.911	1.940	1.967	1.993	2.019	2.043	2.067
26	7.5	24.05	7.5	1.262	1.853	1.884	1.914	1.942	1.969	1.996	2.021	2.045	2.068
26	10	23.40	10	1.277	1.857	1.887	1.917	1.945	1.972	1.998	2.023	2.047	2.070
26	12.5	22.75	12.5	1.293	1.860	1.890	1.920	1.947	1.974	2.000	2.025	2.049	2.072
26	15	22.10	15	1.308	1.864	1.894	1.923	1.950	1.977	2.002	2.027	2.050	2.073
28	0	28.00	0	1.240	1.852	1.884	1.914	1.943	1.970	1.997	2.023	2.048	2.071
28	2.5	27.30	2.5	1.254	1.855	1.886	1.916	1.945	1.973	1.999	2.025	2.049	2.073
28	5	26.60	5	1.269	1.858	1.889	1.919	1.947	1.975	2.001	2.026	2.051	2.074
28	7.5	25.90	7.5	1.283	1.861	1.892	1.922	1.950	1.977	2.003	2.028	2.052	2.076
28	10	25.20	10	1.298	1.865	1.895	1.924	1.952	1.979	2.005	2.030	2.054	2.077
28	12.5	24.50	12.5	1.313	1.868	1.898	1.927	1.955	1.982	2.008	2.032	2.056	2.079
28	15	23.80	15	1.329	1.872	1.902	1.930	1.958	1.984	2.010	2.034	2.058	2.080
30	0	30.00	0	1.262	1.861	1.892	1.922	1.951	1.978	2.005	2.031	2.056	2.079
30	2.5	29.25	2.5	1.276	1.863	1.895	1.924	1.953	1.981	2.007	2.033	2.057	2.081
30	5	28.50	5	1.290	1.866	1.897	1.927	1.955	1.983	2.009	2.034	2.059	2.082
30	7.5	27.75	7.5	1.305	1.870	1.900	1.930	1.958	1.985	2.011	2.036	2.060	2.083
30	10	27.00	10	1.319	1.873	1.903	1.933	1.961	1.987	2.013	2.038	2.062	2.085
30	12.5	26.25	12.5	1.335	1.876	1.907	1.935	1.963	1.990	2.015	2.040	2.064	2.086
30	15	25.50	15	1.350	1.880	1.910	1.939	1.966	1.992	2.018	2.042	2.066	2.088
32	0	32.00	0	1.285	1.869	1.901	1.931	1.959	1.987	2.014	2.039	2.064	2.088
32	2.5	31.20	2.5	1.298	1.872	1.903	1.933	1.962	1.989	2.015	2.041	2.065	2.089
32	5	30.40	5	1.312	1.875	1.906	1.936	1.964	1.991	2.017	2.043	2.067	2.090
32	7.5	29.60	7.5	1.327	1.878	1.909	1.938	1.966	1.993	2.019	2.044	2.068	2.092
32	10	28.80	10	1.342	1.882	1.912	1.941	1.969	1.996	2.022	2.046	2.070	2.093
32	12.5	28.00	12.5	1.357	1.885	1.915	1.944	1.972	1.998	2.024	2.048	2.072	2.094
32	15	27.20	15	1.372	1.889	1.918	1.947	1.974	2.001	2.026	2.050	2.074	2.096
34	0	34.00	0	1.308	1.878	1.910	1.940	1.968	1.996	2.022	2.048	2.072	2.096
34	2.5	33.15	2.5	1.322	1.881	1.912	1.942	1.971	1.998	2.024	2.050	2.074	2.097
34	5	32.30	5	1.336	1.884	1.915	1.945	1.973	2.000	2.026	2.051	2.075	2.099
34	7.5	31.45	7.5	1.350	1.887	1.918	1.947	1.975	2.002	2.028	2.053	2.077	2.100
34	10	30.60	10	1.364	1.891	1.921	1.950	1.978	2.005	2.030	2.055	2.079	2.101
34	12.5	29.75	12.5	1.379	1.894	1.924	1.953	1.980	2.007	2.032	2.057	2.080	2.103
34	15	28.90	15	1.394	1.898	1.927	1.956	1.983	2.009	2.035	2.059	2.082	2.104
36	0	36.00	0	1.332	1.888	1.919	1.949	1.978	2.005	2.032	2.057	2.081	2.105
36	2.5	35.10	2.5	1.346	1.891	1.922	1.951	1.980	2.007	2.033	2.059	2.083	2.106
36	5	34.20	5	1.359	1.894	1.925	1.954	1.982	2.009	2.035	2.060	2.084	2.107
36	7.5	33.30	7.5	1.374	1.897	1.927	1.957	1.985	2.011	2.037	2.062	2.086	2.109
36	10	32.40	10	1.388	1.900	1.930	1.959	1.987	2.014	2.039	2.064	2.087	2.110
36	12.5	31.50	12.5	1.403	1.904	1.934	1.962	1.990	2.016	2.041	2.066	2.089	2.111
36	15	30.60	15	1.418	1.907	1.937	1.965	1.992	2.018	2.043	2.068	2.091	2.113
38	0	38.00	0	1.357	1.898	1.929	1.959	1.987	2.015	2.041	2.067	2.091	2.114
38	2.5	37.05	2.5	1.370	1.901	1.932	1.961	1.990	2.017	2.043	2.068	2.092	2.116
38	5	36.10	5	1.384	1.904	1.934	1.964	1.992	2.019	2.045	2.070	2.094	2.117
38	7.5	35.15	7.5	1.398	1.907	1.937	1.966	1.994	2.021	2.047	2.071	2.095	2.118
38	10	34.20	10	1.412	1.910	1.940	1.969	1.997	2.023	2.049	2.073	2.097	2.119
38	12.5	33.25	12.5	1.427	1.914	1.943	1.972	1.999	2.026	2.051	2.075	2.098	2.120
38	15	32.30	15	1.442	1.917	1.947	1.975	2.002	2.028	2.053	2.077	2.100	2.122
40	0	40.00	0	1.383	1.909	1.940	1.969	1.998	2.025	2.051	2.077	2.101	2.124
40	2.5	39.00	2.5	1.396	1.911	1.942	1.972	2.000	2.027	2.053	2.078	2.102	2.125
40	5	38.00	5	1.410	1.914	1.945	1.974	2.002	2.029	2.055	2.080	2.104	2.126
40	7.5	37.00	7.5	1.424	1.917	1.948	1.977	2.005	2.031	2.057	2.081	2.105	2.128
40	10	36.00	10	1.438	1.921	1.951	1.979	2.007	2.033	2.059	2.083	2.106	2.129
40	12.5	35.00	12.5	1.452	1.924	1.954	1.982	2.009	2.035	2.061	2.085	2.108	2.130
40	15	34.00	15	1.467	1.927	1.957	1.985	2.012	2.038	2.063	2.086	2.109	2.131

LINEAR REGRESSION OF INPUT SP. GR. vS OUTPUT SP. GR.

or Pozzolan Sp. Gr. of 2.6

Regression Output:

onstant		1.390391
td Err of Y Est		0.004826
Squared		0.987970
lo. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.367152	
td Err of Coef.	0.003365	

or Pozzolan Sp. Gr. of 2.7

Regression Output:

onstant		1.425536
td Err of Y Est		0.005126
Squared		0.986196
lo. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.363670	
td Err of Coef.	0.003573	

or Pozzolan Sp. Gr. of 2.8

Regression Output:

onstant		1.459610
td Err of Y Est		0.005422
Squared		0.984269
lo. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.360033	
td Err of Coef.	0.003780	

or Pozzolan Sp. Gr. of 2.9

Regression Output:

onstant		1.492655
td Err of Y Est		0.005716
Squared		0.982186
lo. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.356267	
td Err of Coef.	0.003985	

or Pozzolan Sp. Gr. of 3.0

Regression Output:

onstant		1.524714
td Err of Y Est		0.006006
Squared		0.979945
lo. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.352396	
td Err of Coef.	0.004187	

or Pozzolan Sp. Gr. of 3.1

Regression Output:

onstant		1.5558243395908
td Err of Y Est		0.0062913557789782
Squared		0.97754361527386
lo. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.348440	
td Err of Coef.	0.004386	

or Pozzolan Sp. Gr. of 3.2

Regression Output:

onstant		1.5860249637355
td Err of Y Est		0.0065727649118199
Squared		0.9749796895001
lo. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.344418	
td Err of Coef.	0.004582	

or Pozzolan Sp. Gr. of 3.3

Regression Output:

onstant		1.6153517845892
td Err of Y Est		0.0068496242911872
Squared		0.97225096116413
lo. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.340344	
td Err of Coef.	0.004775	

or Pozzolan Sp. Gr. of 3.4

Regression Output:

onstant		1.643839
td Err of Y Est		0.007122
Squared		0.969355
lo. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.336232	
td Err of Coef.	0.004965	

POZZOLAN SPECIFIC GRAVITY	X COEFF-ICIENT m	Y INTER-CEPT c
2.6	0.3671524	1.3903912
2.7	0.3636704	1.4255362
2.8	0.3600330	1.4596100
2.9	0.3562670	1.4926555
3.0	0.3523960	1.5247138
3.1	0.3484403	1.5558243
3.2	0.3444177	1.5860250
3.3	0.3403439	1.6153518
3.4	0.3362323	1.6438393

INEAR REGRESSION OF X COEFFICIENT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

onstant		0.468465
td Err of Y Est		0.000296
Squared		0.999323
lo. of Observations		9
egrees of Freedom		7
Coefficient(s)	-0.038786	
td Err of Coef.	0.000382	

INEAR REGRESSION OF Y INTERCEPT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

onstant		0.571931
td Err of Y Est		0.003152
Squared		0.999845
lo. of Observations		9
egrees of Freedom		7
Coefficient(s)	0.316540	
td Err of Coef.	0.004069	

TABLE G 6

OUTPUT PRODUCT SPECIFIC GRAVITIES FOR DIFFERENT TDS & TSS CONDITIONS FOR A WATER TO POZZOLAN RATIO OF 0.44

				PECIFIC GRAVITY OF POZZOLANS	2.600	2.70	2.80	2.90	3.00	3.10	3.20	3.30	3.40
				PECIFIC GRAVITY OF SALT	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251
				PECIFIC GRAVITY OF SILT	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23
				W/P RATIO	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44
TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.
0	0	0.00	0	1.000	1.746	1.777	1.806	1.835	1.862	1.888	1.914	1.938	1.962
0	2.5	0.00	2.5	1.014	1.749	1.780	1.809	1.837	1.864	1.891	1.916	1.940	1.963
0	5	0.00	5	1.028	1.752	1.783	1.812	1.840	1.867	1.893	1.918	1.942	1.965
0	7.5	0.00	7.5	1.043	1.756	1.786	1.815	1.843	1.870	1.895	1.920	1.944	1.967
0	10	0.00	10	1.058	1.759	1.789	1.818	1.846	1.872	1.898	1.923	1.946	1.969
0	12.5	0.00	12.5	1.074	1.762	1.792	1.821	1.848	1.875	1.901	1.925	1.949	1.971
0	15	0.00	15	1.090	1.766	1.796	1.824	1.852	1.878	1.903	1.928	1.951	1.974
2	0	2.00	0	1.014	1.751	1.782	1.811	1.840	1.867	1.893	1.919	1.943	1.966
2	2.5	1.95	2.5	1.028	1.754	1.785	1.814	1.842	1.869	1.895	1.921	1.945	1.968
2	5	1.90	5	1.042	1.757	1.788	1.817	1.845	1.872	1.898	1.923	1.947	1.970
2	7.5	1.85	7.5	1.057	1.761	1.791	1.820	1.848	1.874	1.900	1.925	1.949	1.972
2	10	1.80	10	1.073	1.764	1.794	1.823	1.851	1.877	1.903	1.927	1.951	1.974
2	12.5	1.75	12.5	1.088	1.767	1.797	1.826	1.854	1.880	1.905	1.930	1.954	1.976
2	15	1.70	15	1.104	1.771	1.801	1.829	1.857	1.883	1.908	1.933	1.956	1.978
4	0	4.00	0	1.028	1.756	1.787	1.817	1.845	1.872	1.898	1.924	1.948	1.971
4	2.5	3.90	2.5	1.043	1.759	1.790	1.819	1.847	1.875	1.901	1.926	1.950	1.973
4	5	3.80	5	1.057	1.763	1.793	1.822	1.850	1.877	1.903	1.928	1.952	1.975
4	7.5	3.70	7.5	1.072	1.766	1.796	1.825	1.853	1.880	1.905	1.930	1.954	1.977
4	10	3.60	10	1.087	1.769	1.799	1.828	1.856	1.882	1.908	1.933	1.956	1.979
4	12.5	3.50	12.5	1.103	1.773	1.803	1.831	1.859	1.885	1.911	1.935	1.959	1.981
4	15	3.40	15	1.119	1.776	1.806	1.834	1.862	1.888	1.913	1.938	1.961	1.983
6	0	6.00	0	1.043	1.762	1.793	1.822	1.850	1.877	1.904	1.929	1.953	1.977
6	2.5	5.85	2.5	1.057	1.765	1.795	1.825	1.853	1.880	1.906	1.931	1.955	1.978
6	5	5.70	5	1.072	1.768	1.798	1.827	1.855	1.882	1.908	1.933	1.957	1.980
6	7.5	5.55	7.5	1.087	1.771	1.801	1.830	1.858	1.885	1.911	1.935	1.959	1.982
6	10	5.40	10	1.102	1.775	1.805	1.833	1.861	1.888	1.913	1.938	1.961	1.984
6	12.5	5.25	12.5	1.118	1.778	1.808	1.837	1.864	1.890	1.916	1.940	1.964	1.986
6	15	5.10	15	1.134	1.782	1.811	1.840	1.867	1.893	1.919	1.943	1.966	1.989
8	0	8.00	0	1.059	1.767	1.798	1.827	1.856	1.883	1.909	1.934	1.958	1.982
8	2.5	7.80	2.5	1.073	1.770	1.801	1.830	1.858	1.885	1.911	1.936	1.960	1.984
8	5	7.60	5	1.087	1.774	1.804	1.833	1.861	1.888	1.914	1.939	1.962	1.986
8	7.5	7.40	7.5	1.102	1.777	1.807	1.836	1.864	1.890	1.916	1.941	1.965	1.988
8	10	7.20	10	1.117	1.780	1.810	1.839	1.867	1.893	1.919	1.943	1.967	1.990
8	12.5	7.00	12.5	1.133	1.784	1.814	1.842	1.870	1.896	1.921	1.946	1.969	1.992
8	15	6.80	15	1.149	1.787	1.817	1.845	1.873	1.899	1.924	1.948	1.971	1.994
10	0	10.00	0	1.074	1.773	1.804	1.833	1.861	1.889	1.915	1.940	1.964	1.987
10	2.5	9.75	2.5	1.088	1.776	1.807	1.836	1.864	1.891	1.917	1.942	1.966	1.989
10	5	9.50	5	1.103	1.779	1.810	1.839	1.867	1.893	1.919	1.944	1.968	1.991
10	7.5	9.25	7.5	1.118	1.783	1.813	1.842	1.869	1.896	1.922	1.946	1.970	1.993
10	10	9.00	10	1.133	1.786	1.816	1.845	1.872	1.899	1.924	1.949	1.972	1.995
10	12.5	8.75	12.5	1.149	1.790	1.819	1.848	1.875	1.902	1.927	1.951	1.975	1.997
10	15	8.50	15	1.165	1.793	1.823	1.851	1.878	1.905	1.930	1.954	1.977	1.999
12	0	12.00	0	1.091	1.779	1.810	1.839	1.867	1.894	1.921	1.946	1.970	1.993
12	2.5	11.70	2.5	1.105	1.782	1.813	1.842	1.870	1.897	1.923	1.948	1.972	1.995
12	5	11.40	5	1.119	1.785	1.816	1.845	1.873	1.899	1.925	1.950	1.974	1.997
12	7.5	11.10	7.5	1.134	1.789	1.819	1.848	1.875	1.902	1.928	1.952	1.976	1.999
12	10	10.80	10	1.149	1.792	1.822	1.851	1.878	1.905	1.930	1.955	1.978	2.001
12	12.5	10.50	12.5	1.165	1.796	1.825	1.854	1.881	1.907	1.933	1.957	1.980	2.003
12	15	10.20	15	1.181	1.799	1.829	1.857	1.884	1.910	1.935	1.960	1.983	2.005
14	0	14.00	0	1.107	1.785	1.816	1.845	1.873	1.901	1.927	1.952	1.976	1.999
14	2.5	13.65	2.5	1.121	1.788	1.819	1.848	1.876	1.903	1.929	1.954	1.978	2.001
14	5	13.30	5	1.136	1.792	1.822	1.851	1.879	1.905	1.931	1.956	1.980	2.003
14	7.5	12.95	7.5	1.151	1.795	1.825	1.854	1.882	1.908	1.934	1.958	1.982	2.005
14	10	12.60	10	1.166	1.798	1.828	1.857	1.884	1.911	1.936	1.961	1.984	2.007
14	12.5	12.25	12.5	1.182	1.802	1.832	1.860	1.887	1.914	1.939	1.963	1.986	2.009
14	15	11.90	15	1.198	1.806	1.835	1.863	1.891	1.917	1.941	1.965	1.989	2.011
16	0	16.00	0	1.125	1.792	1.822	1.852	1.880	1.907	1.933	1.958	1.982	2.005
16	2.5	15.60	2.5	1.139	1.795	1.825	1.854	1.882	1.909	1.935	1.960	1.984	2.007
16	5	15.20	5	1.153	1.798	1.828	1.857	1.885	1.912	1.937	1.962	1.986	2.009
16	7.5	14.80	7.5	1.168	1.801	1.831	1.860	1.888	1.914	1.940	1.964	1.988	2.011
16	10	14.40	10	1.183	1.805	1.835	1.863	1.891	1.917	1.942	1.967	1.990	2.013
16	12.5	14.00	12.5	1.199	1.809	1.838	1.867	1.894	1.920	1.945	1.969	1.992	2.015
16	15	13.60	15	1.215	1.812	1.842	1.870	1.897	1.923	1.948	1.972	1.995	2.017
18	0	18.00	0	1.142	1.799	1.829	1.858	1.886	1.913	1.939	1.964	1.988	2.012
18	2.5	17.55	2.5	1.156	1.802	1.832	1.861	1.889	1.916	1.942	1.966	1.990	2.013
18	5	17.10	5	1.171	1.805	1.835	1.864	1.892	1.918	1.944	1.969	1.992	2.015
18	7.5	16.65	7.5	1.186	1.808	1.838	1.867	1.894	1.921	1.946	1.971	1.994	2.017
18	10	16.20	10	1.201	1.812	1.841	1.870	1.897	1.924	1.949	1.973	1.997	2.019
18	12.5	15.75	12.5	1.217	1.815	1.845	1.873	1.900	1.926	1.952	1.976	1.999	2.021
18	15	15.30	15	1.233	1.819	1.848	1.877	1.903	1.929	1.954	1.978	2.001	2.023
20	0	20.00	0	1.161	1.806	1.836	1.865	1.893	1.920	1.946	1.971	1.995	2.018
20	2.5	19.50	2.5	1.175	1.809	1.839	1.868	1.896	1.923	1.948	1.973	1.997	2.020
20	5	19.00	5	1.189	1.812	1.842	1.871	1.899	1.925	1.951	1.975	1.999	2.022
20	7.5	18.50	7.5	1.204	1.815	1.845	1.874	1.901	1.928	1.953	1.978	2.001	2.024
20	10	18.00	10	1.219	1.819	1.848	1.877	1.904	1.930	1.956	1.980	2.003	2.026
20	12.5	17.50	12.5	1.235	1.822	1.852	1.880	1.907	1.933	1.958	1.982	2.005	2.028
20	15	17.00	15	1.251	1.826	1.855	1.883	1.910	1.936	1.961	1.985	2.008	2.030
22	0	22.00	0	1.180	1.813	1.843	1.872	1.900	1.927	1.953	1.978	2.002	2.025
22	2.5	21.45	2.5	1.194	1.816	1.846	1.875	1.903	1.930	1.956	1.980	2.004	2.027
22	5	20.90	5	1.208	1.819	1.849	1.878	1.906	1.932	1.958	1.982	2.006	2.029
22	7.5	20.35	7.5	1.223	1.823	1.852	1.881	1.908	1.935	1.960	1.985	2.008	2.031
22	10	19.80	10	1.238	1.826	1.856	1.884	1.911	1.938	1.963	1.987	2.010	2.032
22	12.5	19.25	12.5	1.253	1.830	1.859	1.887	1.914	1.940	1.965	1.989	2.012	2.034
22	15	18.70	15	1.269	1.833	1.863	1.891	1.917	1.943	1.968	1.992	2.014	2.036
24	0	24.00	0	1.199	1.820	1.851	1.880	1.908	1.935	1.961	1.985	2.009	2.032
24	2.5	23.40	2.5	1.213	1.824	1.854	1.883	1.911	1.937	1.963	1.988	2.011	2.034
24	5	22.80	5	1.228	1.827	1.857	1.886	1.913	1.940	1.965	1.990	2.013	2.036
24	7.5	22.20	7.5	1.242	1.830	1.860	1.889	1.916	1.942	1.968	1.992	2.015	2.038
24	10	21.60	10	1.257	1.834	1.863	1.892	1.919	1.945	1.970	1.994	2.017	2.040
24	12.5	21.00	12.5	1.273	1.837	1.867	1.895	1.922	1.948	1.973	1.996	2.019	2.041
24	15	20.40	15	1.289	1.841	1.870	1.898	1.925	1.951	1.975	1.999	2.022	2.043
26	0	26.00	0	1.220	1.828	1.859	1.888	1.916	1.943	1.968	1.993	2.017	2.040
26	2.5	25.35	2.5	1.234	1.831	1.862	1.891	1.918	1.945	1.971	1.995	2.019	2.042
26	5	24.70	5	1.248	1.835	1.865	1.893	1.921	1.947	1.973	1.997	2.021	2.043
26	7.5	24.05	7.5	1.262	1.838	1.868	1.896	1.924	1.950	1.975	1.999	2.023	2.045
26	10	23.40	10	1.277	1.842	1.871	1.899	1.927	1.953	1.978	2.002	2.025	2.047
26	12.5	22.75	12.5	1.293	1.845	1.874	1.903	1.929	1.955	1.980	2.004	2.027	2.049
26	15	22.10	15	1.308	1.849	1.878	1.906	1.933	1.958	1.983	2.006	2.029	2.051
28	0	28.00	0	1.240	1.837	1.867	1.896	1.924	1.951	1.976	2.001	2.025	2.048
28	2.5	27.30	2.5	1.254	1.840	1.870	1.899	1.926	1.953	1.978	2.003	2.027	2.049
28	5	26.60	5	1.269	1.843	1.873	1.901	1.929	1.955	1.981	2.005	2.029	2.051
28	7.5	25.90	7.5	1.283	1.846	1.876	1.904	1.932	1.958	1.983	2.007	2.030	2.053
28	10	25.20	10	1.298	1.850	1.879	1.907	1.935	1.961	1.985	2.009	2.032	2.055
28	12.5	24.50	12.5	1.313	1.853	1.883	1.911	1.937	1.963	1.988	2.012	2.034	2.056
28	15	23.80	15	1.329	1.857	1.886	1.914	1.941	1.966	1.991	2.014	2.037	2.058
30	0	30.00	0	1.262	1.845	1.875	1.904	1.932	1.959	1.985	2.009	2.033	2.056
30	2.5	29.25	2.5	1.276	1.848	1.878	1.907	1.935	1.961	1.987	2.011	2.035	2.058
30	5	28.50	5	1.290	1.852	1.881	1.910	1.937	1.964	1.989	2.013	2.037	2.059
30	7.5	27.75	7.5	1.305	1.855	1.885	1.913	1.940	1.966	1.991	2.015	2.039	2.061
30	10	27.00	10	1.319	1.858	1.888	1.916	1.943	1.969	1.994	2.018	2.040	2.063
30	12.5	26.25	12.5	1.335	1.862	1.891	1.919	1.946	1.971	1.996	2.020	2.043	2.064
30	15	25.50	15	1.350	1.866	1.895	1.922	1.949	1.974	1.999	2.022	2.045	2.066
32	0	32.00	0	1.285	1.854	1.884	1.913	1.941	1.968	1.993	2.018	2.042	2.064
32	2.5	31.20	2.5	1.298	1.857	1.887	1.916	1.944	1.970	1.995	2.020	2.043	2.066
32	5	30.40	5	1.312	1.861	1.890	1.919	1.946	1.972	1.998	2.022	2.045	2.068
32	7.5	29.60	7.5	1.327	1.864	1.893	1.922	1.949	1.975	2.000	2.024	2.047	2.069
32	10	28.80	10	1.342	1.867	1.897	1.925	1.952	1.977	2.002	2.026	2.049	2.071
32	12.5	28.00	12.5	1.357	1.871	1.900	1.928	1.955	1.980	2.005	2.028	2.051	2.073
32	15	27.20	15	1.372	1.875	1.904	1.931	1.958	1.983	2.007	2.030	2.053	2.074
34	0	34.00	0	1.308	1.864	1.894	1.923	1.950	1.977	2.002	2.027	2.051	2.073
34	2.5	33.15	2.5	1.322	1.867	1.897	1.925	1.953	1.979	2.005	2.029	2.052	2.075
34	5	32.30	5	1.336	1.870	1.900	1.928	1.955	1.982	2.007	2.031	2.054	2.076
34	7.5	31.45	7.5	1.350	1.873	1.903	1.931	1.958	1.984	2.009	2.033	2.056	2.078
34	10	30.60	10	1.364	1.877	1.906	1.934	1.961	1.987	2.011	2.035	2.058	2.080
34	12.5	29.75	12.5	1.379	1.880	1.909	1.937	1.964	1.989	2.014	2.037	2.060	2.081
34	15	28.90	15	1.394	1.884	1.913	1.940	1.967	1.992	2.016	2.039	2.062	2.083
36	0	36.00	0	1.332	1.873	1.904	1.932	1.960	1.987	2.012	2.036	2.060	2.083
36	2.5	35.10	2.5	1.346	1.877	1.906	1.935	1.962	1.989	2.014	2.038	2.062	2.084
36	5	34.20	5	1.359	1.880	1.909	1.938	1.965	1.991	2.016	2.040	2.063	2.086
36	7.5	33.30	7.5	1.374	1.883	1.913	1.941	1.968	1.994	2.018	2.042	2.065	2.087
36	10	32.40	10	1.388	1.887	1.916	1.944	1.970	1.996	2.021	2.044	2.067	2.089
36	12.5	31.50	12.5	1.403	1.890	1.919	1.947	1.973	1.999	2.023	2.046	2.069	2.090
36	15	30.60	15	1.418	1.894	1.922	1.950	1.976	2.001	2.025	2.048	2.071	2.092
38	0	38.00	0	1.357	1.884	1.914	1.943	1.970	1.997	2.022	2.046	2.070	2.092
38	2.5	37.05	2.5	1.370	1.887	1.917	1.945	1.973	1.999	2.024	2.048	2.071	2.094
38	5	36.10	5	1.384	1.890	1.920	1.948	1.975	2.001	2.026	2.050	2.073	2.095
38	7.5	35.15	7.5	1.398	1.893	1.923	1.951	1.978	2.003	2.028	2.052	2.075	2.097
38	10	34.20	10	1.412	1.897	1.926	1.954	1.980	2.006	2.030	2.054	2.076	2.098
38	12.5	33.25	12.5	1.427	1.900	1.929	1.957	1.983	2.008	2.033	2.056	2.078	2.100
38	15	32.30	15	1.442	1.904	1.933	1.960	1.986	2.011	2.035	2.058	2.080	2.101
40	0	40.00	0	1.383	1.895	1.925	1.953	1.981	2.007	2.032	2.057	2.080	2.103
40	2.5	39.00	2.5	1.396	1.898	1.927	1.956	1.983	2.009	2.034	2.059	2.082	2.104
40	5	38.00	5	1.410	1.901	1.930	1.959	1.986	2.012	2.036	2.060	2.083	2.105
40	7.5	37.00	7.5	1.424	1.904	1.933	1.961	1.988	2.014	2.038	2.062	2.085	2.107
40	10	36.00	10	1.438	1.908	1.937	1.964	1.991	2.016	2.041	2.064	2.086	2.108
40	12.5	35.00	12.5	1.452	1.911	1.940	1.967	1.994	2.019	2.043	2.066	2.088	2.110
40	15	34.00	15	1.467	1.915	1.943	1.970	1.996	2.021	2.045	2.068	2.090	2.111

LINEAR REGRESSION OF INPUT SP. GR. vS OUTPUT SP. GR.

or Pozzolan Sp. Gr. of 2.6

Regression Output:

onstant		1.359337
td Err of Y Est		0.004804
Squared		0.988841
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.379641	
td Err of Coef.	0.003349	

or Pozzolan Sp. Gr. of 2.7

Regression Output:

onstant		1.393187
td Err of Y Est		0.005097
Squared		0.987239
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.376347	
td Err of Coef.	0.003553	

or Pozzolan Sp. Gr. of 2.8

Regression Output:

onstant		1.425977
td Err of Y Est		0.005387
Squared		0.985506
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.372904	
td Err of Coef.	0.003756	

or Pozzolan Sp. Gr. of 2.9

Regression Output:

onstant		1.457749
td Err of Y Est		0.005674
Squared		0.983642
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.369340	
td Err of Coef.	0.003955	

or Pozzolan Sp. Gr. of 3.0

Regression Output:

onstant		1.488547
td Err of Y Est		0.005957
Squared		0.981645
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.365676	
td Err of Coef.	0.004152	

or Pozzolan Sp. Gr. of 3.1

Regression Output:

onstant		1.5184107
td Err of Y Est		0.0062352
Squared		0.9795156
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.361933	
td Err of Coef.	0.004347	

or Pozzolan Sp. Gr. of 3.2

Regression Output:

onstant		1.5473781
td Err of Y Est		0.0065091
Squared		0.9772519
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.358129	
td Err of Coef.	0.004538	

or Pozzolan Sp. Gr. of 3.3

Regression Output:

onstant		1.5754861
td Err of Y Est		0.0067784
Squared		0.9748536
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.354277	
td Err of Coef.	0.004725	

or Pozzolan Sp. Gr. of 3.4

Regression Output:

onstant		1.602770
td Err of Y Est		0.007043
Squared		0.972320
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.350391	
td Err of Coef.	0.004910	

POZZOLAN SPECIFIC GRAVITY	X COEFF-ICIENT m	Y INTER-CEPT c
2.6	0.3796414	1.3593367
2.7	0.3763468	1.3931872
2.8	0.3729041	1.4259768
2.9	0.3693397	1.4577495
3.0	0.3656761	1.4885474
3.1	0.3619334	1.5184107
3.2	0.3581285	1.5473781
3.3	0.3542766	1.5754861
3.4	0.3503907	1.6027697

LINEAR REGRESSION OF X COEFFICIENT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

onstant		0.475489
td Err of Y Est		0.000278
Squared		0.999333
o. of Observations		9
egrees of Freedom		7
Coefficient(s)	-0.036695	
td Err of Coef.	0.000358	

LINEAR REGRESSION OF Y INTERCEPT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

onstant		0.573381
td Err of Y Est		0.003109
Squared		0.998782
o. of Observations		9
egrees of Freedom		7
Coefficient(s)	0.304016	
td Err of Coef.	0.004013	

OUTPUT PRODUCT SPECIFIC GRAVITIES FOR DIFFERENT TDS & TSS CONDITIONS FOR A WATER TO POZZOLAN RATIO OF 0.46

SPECIFIC GRAVITY OF POZZOLANS					2.600	2.70	2.80	2.90	3.00	3.10	3.20	3.30	3.40
SPECIFIC GRAVITY OF SALT					3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251
SPECIFIC GRAVITY OF SILT					2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23
W/P RATIO					0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.
0	0	0.00	0	1.000	1.729	1.758	1.787	1.814	1.840	1.866	1.890	1.913	1.936
0	2.5	0.00	2.5	1.014	1.732	1.761	1.790	1.817	1.843	1.868	1.892	1.916	1.938
0	5	0.00	5	1.028	1.735	1.764	1.793	1.820	1.846	1.871	1.895	1.918	1.940
0	7.5	0.00	7.5	1.043	1.738	1.768	1.796	1.823	1.848	1.873	1.897	1.920	1.942
0	10	0.00	10	1.058	1.742	1.771	1.799	1.826	1.851	1.876	1.900	1.923	1.945
0	12.5	0.00	12.5	1.074	1.746	1.774	1.802	1.829	1.854	1.879	1.902	1.925	1.947
0	15	0.00	15	1.090	1.749	1.778	1.806	1.832	1.857	1.882	1.905	1.928	1.950
2	0	2.00	0	1.014	1.734	1.763	1.792	1.819	1.845	1.871	1.895	1.918	1.941
2	2.5	1.95	2.5	1.028	1.737	1.766	1.795	1.822	1.848	1.873	1.897	1.921	1.943
2	5	1.90	5	1.042	1.740	1.770	1.798	1.825	1.851	1.876	1.900	1.923	1.945
2	7.5	1.85	7.5	1.057	1.744	1.773	1.801	1.828	1.854	1.878	1.902	1.925	1.947
2	10	1.80	10	1.073	1.747	1.776	1.804	1.831	1.856	1.881	1.905	1.928	1.950
2	12.5	1.75	12.5	1.088	1.751	1.780	1.807	1.834	1.859	1.884	1.908	1.930	1.952
2	15	1.70	15	1.104	1.755	1.783	1.811	1.837	1.863	1.887	1.910	1.933	1.955
4	0	4.00	0	1.028	1.739	1.769	1.797	1.825	1.851	1.876	1.900	1.924	1.946
4	2.5	3.90	2.5	1.043	1.742	1.772	1.800	1.827	1.853	1.878	1.903	1.926	1.948
4	5	3.80	5	1.057	1.746	1.775	1.803	1.830	1.856	1.881	1.905	1.928	1.950
4	7.5	3.70	7.5	1.072	1.749	1.778	1.806	1.833	1.859	1.884	1.907	1.930	1.953
4	10	3.60	10	1.087	1.753	1.782	1.809	1.836	1.862	1.886	1.910	1.933	1.955
4	12.5	3.50	12.5	1.103	1.756	1.785	1.813	1.839	1.865	1.889	1.913	1.935	1.957
4	15	3.40	15	1.119	1.760	1.789	1.816	1.843	1.868	1.892	1.916	1.938	1.960
6	0	6.00	0	1.043	1.745	1.774	1.803	1.830	1.856	1.881	1.906	1.929	1.952
6	2.5	5.85	2.5	1.057	1.748	1.777	1.806	1.833	1.859	1.884	1.908	1.931	1.954
6	5	5.70	5	1.072	1.751	1.780	1.809	1.836	1.862	1.886	1.910	1.934	1.956
6	7.5	5.55	7.5	1.087	1.755	1.784	1.812	1.839	1.864	1.889	1.913	1.936	1.958
6	10	5.40	10	1.102	1.758	1.787	1.815	1.842	1.867	1.892	1.916	1.938	1.960
6	12.5	5.25	12.5	1.118	1.762	1.791	1.818	1.845	1.870	1.895	1.918	1.941	1.963
6	15	5.10	15	1.134	1.766	1.794	1.822	1.848	1.873	1.898	1.921	1.943	1.965
8	0	8.00	0	1.059	1.750	1.780	1.808	1.836	1.862	1.887	1.911	1.935	1.957
8	2.5	7.80	2.5	1.073	1.754	1.783	1.811	1.838	1.864	1.890	1.914	1.937	1.959
8	5	7.60	5	1.087	1.757	1.786	1.814	1.841	1.867	1.892	1.916	1.939	1.961
8	7.5	7.40	7.5	1.102	1.760	1.790	1.817	1.844	1.870	1.895	1.919	1.941	1.963
8	10	7.20	10	1.117	1.764	1.793	1.821	1.847	1.873	1.897	1.921	1.944	1.966
8	12.5	7.00	12.5	1.133	1.768	1.797	1.824	1.851	1.876	1.900	1.924	1.946	1.968
8	15	6.80	15	1.149	1.772	1.800	1.828	1.854	1.879	1.903	1.927	1.949	1.971
10	0	10.00	0	1.074	1.756	1.786	1.814	1.842	1.868	1.893	1.917	1.940	1.963
10	2.5	9.75	2.5	1.088	1.760	1.789	1.817	1.844	1.870	1.895	1.919	1.943	1.965
10	5	9.50	5	1.103	1.763	1.792	1.820	1.847	1.873	1.898	1.922	1.945	1.967
10	7.5	9.25	7.5	1.118	1.766	1.796	1.823	1.850	1.876	1.901	1.924	1.947	1.969
10	10	9.00	10	1.133	1.770	1.799	1.827	1.853	1.879	1.903	1.927	1.950	1.971
10	12.5	8.75	12.5	1.149	1.774	1.803	1.830	1.856	1.882	1.906	1.930	1.952	1.974
10	15	8.50	15	1.165	1.778	1.806	1.834	1.860	1.885	1.909	1.932	1.955	1.976
12	0	12.00	0	1.091	1.763	1.792	1.820	1.848	1.874	1.899	1.923	1.946	1.969
12	2.5	11.70	2.5	1.105	1.766	1.795	1.823	1.850	1.876	1.901	1.925	1.949	1.971
12	5	11.40	5	1.119	1.769	1.798	1.826	1.853	1.879	1.904	1.928	1.951	1.973
12	7.5	11.10	7.5	1.134	1.773	1.802	1.830	1.856	1.882	1.907	1.930	1.953	1.975
12	10	10.80	10	1.149	1.776	1.805	1.833	1.859	1.885	1.909	1.933	1.956	1.977
12	12.5	10.50	12.5	1.165	1.780	1.809	1.836	1.863	1.888	1.912	1.936	1.958	1.980
12	15	10.20	15	1.181	1.784	1.812	1.840	1.866	1.891	1.915	1.938	1.961	1.982
14	0	14.00	0	1.107	1.769	1.799	1.827	1.854	1.880	1.905	1.929	1.953	1.975
14	2.5	13.65	2.5	1.121	1.772	1.802	1.830	1.857	1.883	1.908	1.932	1.955	1.977
14	5	13.30	5	1.136	1.776	1.805	1.833	1.860	1.885	1.910	1.934	1.957	1.979
14	7.5	12.95	7.5	1.151	1.779	1.808	1.836	1.863	1.888	1.913	1.937	1.959	1.981
14	10	12.60	10	1.166	1.783	1.812	1.839	1.866	1.891	1.916	1.939	1.962	1.983
14	12.5	12.25	12.5	1.182	1.787	1.815	1.843	1.869	1.894	1.918	1.942	1.964	1.986
14	15	11.90	15	1.198	1.790	1.819	1.846	1.872	1.897	1.921	1.945	1.967	1.988
16	0	16.00	0	1.125	1.776	1.805	1.833	1.861	1.887	1.912	1.936	1.959	1.981
16	2.5	15.60	2.5	1.139	1.779	1.808	1.836	1.863	1.889	1.914	1.938	1.961	1.983
16	5	15.20	5	1.153	1.782	1.811	1.839	1.866	1.892	1.917	1.941	1.963	1.985
16	7.5	14.80	7.5	1.168	1.786	1.815	1.843	1.869	1.895	1.919	1.943	1.966	1.988
16	10	14.40	10	1.183	1.789	1.818	1.846	1.872	1.898	1.922	1.946	1.968	1.990
16	12.5	14.00	12.5	1.199	1.793	1.822	1.849	1.876	1.901	1.925	1.948	1.971	1.992
16	15	13.60	15	1.215	1.797	1.826	1.853	1.879	1.904	1.928	1.951	1.973	1.994
18	0	18.00	0	1.142	1.783	1.812	1.840	1.867	1.893	1.919	1.943	1.966	1.988
18	2.5	17.55	2.5	1.156	1.786	1.815	1.843	1.870	1.896	1.921	1.945	1.968	1.990
18	5	17.10	5	1.171	1.789	1.818	1.846	1.873	1.899	1.923	1.947	1.970	1.992
18	7.5	16.65	7.5	1.186	1.793	1.822	1.849	1.876	1.902	1.926	1.950	1.972	1.994
18	10	16.20	10	1.201	1.796	1.825	1.853	1.879	1.905	1.929	1.952	1.975	1.996
18	12.5	15.75	12.5	1.217	1.800	1.829	1.856	1.882	1.908	1.932	1.955	1.977	1.999
18	15	15.30	15	1.233	1.804	1.833	1.860	1.886	1.911	1.935	1.958	1.980	2.001
20	0	20.00	0	1.161	1.790	1.819	1.847	1.875	1.901	1.926	1.950	1.973	1.995
20	2.5	19.50	2.5	1.175	1.793	1.822	1.850	1.877	1.903	1.928	1.952	1.975	1.997
20	5	19.00	5	1.189	1.796	1.826	1.853	1.880	1.906	1.931	1.954	1.977	1.999
20	7.5	18.50	7.5	1.204	1.800	1.829	1.857	1.883	1.909	1.933	1.957	1.979	2.001
20	10	18.00	10	1.219	1.804	1.832	1.860	1.886	1.912	1.936	1.959	1.982	2.003
20	12.5	17.50	12.5	1.235	1.807	1.836	1.863	1.889	1.915	1.939	1.962	1.984	2.005
20	15	17.00	15	1.251	1.811	1.840	1.867	1.893	1.918	1.942	1.965	1.987	2.008
22	0	22.00	0	1.180	1.797	1.827	1.855	1.882	1.908	1.933	1.957	1.980	2.002
22	2.5	21.45	2.5	1.194	1.801	1.830	1.858	1.885	1.911	1.935	1.959	1.982	2.004
22	5	20.90	5	1.208	1.804	1.833	1.861	1.888	1.913	1.938	1.961	1.984	2.006
22	7.5	20.35	7.5	1.223	1.808	1.836	1.864	1.891	1.916	1.940	1.964	1.986	2.008
22	10	19.80	10	1.238	1.811	1.840	1.867	1.894	1.919	1.943	1.966	1.989	2.010
22	12.5	19.25	12.5	1.253	1.815	1.843	1.871	1.897	1.922	1.946	1.969	1.991	2.012
22	15	18.70	15	1.269	1.819	1.847	1.874	1.900	1.925	1.949	1.972	1.994	2.015
24	0	24.00	0	1.199	1.805	1.834	1.863	1.890	1.916	1.940	1.964	1.987	2.010
24	2.5	23.40	2.5	1.213	1.808	1.838	1.866	1.892	1.918	1.943	1.967	1.989	2.011
24	5	22.80	5	1.228	1.812	1.841	1.869	1.895	1.921	1.945	1.969	1.992	2.013
24	7.5	22.20	7.5	1.242	1.815	1.844	1.872	1.898	1.924	1.948	1.971	1.994	2.016
24	10	21.60	10	1.257	1.819	1.848	1.875	1.901	1.926	1.951	1.974	1.996	2.018
24	12.5	21.00	12.5	1.273	1.823	1.851	1.878	1.904	1.929	1.953	1.976	1.999	2.020
24	15	20.40	15	1.289	1.827	1.855	1.882	1.908	1.933	1.956	1.979	2.001	2.022
26	0	26.00	0	1.220	1.813	1.843	1.871	1.898	1.924	1.948	1.972	1.995	2.017
26	2.5	25.35	2.5	1.234	1.817	1.846	1.874	1.900	1.926	1.951	1.974	1.997	2.019
26	5	24.70	5	1.248	1.820	1.849	1.877	1.903	1.929	1.953	1.977	1.999	2.021
26	7.5	24.05	7.5	1.262	1.823	1.852	1.880	1.906	1.932	1.956	1.979	2.002	2.023
26	10	23.40	10	1.277	1.827	1.856	1.883	1.909	1.934	1.958	1.982	2.004	2.025
26	12.5	22.75	12.5	1.293	1.831	1.859	1.886	1.912	1.937	1.961	1.984	2.006	2.027
26	15	22.10	15	1.308	1.835	1.863	1.890	1.916	1.940	1.964	1.987	2.009	2.030
28	0	28.00	0	1.240	1.822	1.851	1.879	1.906	1.932	1.957	1.980	2.003	2.025
28	2.5	27.30	2.5	1.254	1.825	1.854	1.882	1.909	1.934	1.959	1.983	2.005	2.027
28	5	26.60	5	1.269	1.828	1.857	1.885	1.912	1.937	1.961	1.985	2.007	2.029
28	7.5	25.90	7.5	1.283	1.832	1.861	1.888	1.915	1.940	1.964	1.987	2.010	2.031
28	10	25.20	10	1.298	1.836	1.864	1.891	1.918	1.943	1.967	1.990	2.012	2.033
28	12.5	24.50	12.5	1.313	1.839	1.868	1.895	1.921	1.946	1.969	1.992	2.014	2.035
28	15	23.80	15	1.329	1.843	1.871	1.898	1.924	1.949	1.972	1.995	2.017	2.037
30	0	30.00	0	1.262	1.831	1.860	1.888	1.915	1.941	1.965	1.989	2.012	2.034
30	2.5	29.25	2.5	1.276	1.834	1.863	1.891	1.917	1.943	1.968	1.991	2.014	2.036
30	5	28.50	5	1.290	1.837	1.866	1.894	1.920	1.946	1.970	1.993	2.016	2.038
30	7.5	27.75	7.5	1.305	1.841	1.870	1.897	1.923	1.948	1.973	1.996	2.018	2.039
30	10	27.00	10	1.319	1.845	1.873	1.900	1.926	1.951	1.975	1.998	2.020	2.041
30	12.5	26.25	12.5	1.335	1.848	1.877	1.904	1.929	1.954	1.978	2.001	2.023	2.044
30	15	25.50	15	1.350	1.852	1.880	1.907	1.933	1.957	1.981	2.003	2.025	2.046
32	0	32.00	0	1.285	1.840	1.869	1.897	1.924	1.950	1.974	1.998	2.021	2.043
32	2.5	31.20	2.5	1.298	1.843	1.872	1.900	1.927	1.952	1.977	2.000	2.023	2.044
32	5	30.40	5	1.312	1.847	1.875	1.903	1.929	1.955	1.979	2.002	2.025	2.046
32	7.5	29.60	7.5	1.327	1.850	1.879	1.906	1.932	1.957	1.981	2.005	2.027	2.048
32	10	28.80	10	1.342	1.854	1.882	1.909	1.935	1.960	1.984	2.007	2.029	2.050
32	12.5	28.00	12.5	1.357	1.858	1.886	1.913	1.938	1.963	1.987	2.009	2.031	2.052
32	15	27.20	15	1.372	1.861	1.889	1.916	1.942	1.966	1.989	2.012	2.033	2.054
34	0	34.00	0	1.308	1.850	1.879	1.907	1.933	1.959	1.984	2.007	2.030	2.052
34	2.5	33.15	2.5	1.322	1.853	1.882	1.910	1.936	1.962	1.986	2.009	2.032	2.054
34	5	32.30	5	1.336	1.856	1.885	1.913	1.939	1.964	1.988	2.012	2.034	2.055
34	7.5	31.45	7.5	1.350	1.860	1.888	1.916	1.942	1.967	1.991	2.014	2.036	2.057
34	10	30.60	10	1.364	1.863	1.892	1.919	1.945	1.969	1.993	2.016	2.038	2.059
34	12.5	29.75	12.5	1.379	1.867	1.895	1.922	1.948	1.972	1.996	2.018	2.040	2.061
34	15	28.90	15	1.394	1.871	1.899	1.926	1.951	1.975	1.999	2.021	2.042	2.063
36	0	36.00	0	1.332	1.860	1.889	1.917	1.943	1.969	1.994	2.017	2.040	2.062
36	2.5	35.10	2.5	1.346	1.863	1.892	1.920	1.946	1.971	1.996	2.019	2.042	2.063
36	5	34.20	5	1.359	1.866	1.895	1.922	1.949	1.974	1.998	2.021	2.044	2.065
36	7.5	33.30	7.5	1.374	1.870	1.898	1.926	1.952	1.977	2.000	2.023	2.045	2.067
36	10	32.40	10	1.388	1.874	1.902	1.929	1.955	1.979	2.003	2.026	2.048	2.069
36	12.5	31.50	12.5	1.403	1.877	1.905	1.932	1.958	1.982	2.006	2.028	2.050	2.070
36	15	30.60	15	1.418	1.881	1.909	1.935	1.961	1.985	2.008	2.030	2.052	2.072
38	0	38.00	0	1.357	1.870	1.899	1.927	1.954	1.979	2.004	2.027	2.050	2.072
38	2.5	37.05	2.5	1.370	1.874	1.902	1.930	1.956	1.982	2.006	2.029	2.052	2.073
38	5	36.10	5	1.384	1.877	1.906	1.933	1.959	1.984	2.008	2.031	2.054	2.075
38	7.5	35.15	7.5	1.398	1.880	1.909	1.936	1.962	1.987	2.011	2.034	2.055	2.077
38	10	34.20	10	1.412	1.884	1.912	1.939	1.965	1.989	2.013	2.036	2.057	2.078
38	12.5	33.25	12.5	1.427	1.888	1.916	1.942	1.968	1.992	2.016	2.038	2.059	2.080
38	15	32.30	15	1.442	1.892	1.919	1.946	1.971	1.995	2.018	2.040	2.062	2.082
40	0	40.00	0	1.383	1.882	1.911	1.938	1.965	1.990	2.015	2.038	2.061	2.082
40	2.5	39.00	2.5	1.396	1.885	1.914	1.941	1.967	1.993	2.017	2.040	2.062	2.084
40	5	38.00	5	1.410	1.888	1.917	1.944	1.970	1.995	2.019	2.042	2.064	2.085
40	7.5	37.00	7.5	1.424	1.892	1.920	1.947	1.973	1.998	2.021	2.044	2.066	2.087
40	10	36.00	10	1.438	1.895	1.923	1.950	1.976	2.000	2.024	2.046	2.068	2.089
40	12.5	35.00	12.5	1.452	1.899	1.927	1.953	1.979	2.003	2.026	2.048	2.070	2.090
40	15	34.00	15	1.467	1.903	1.930	1.956	1.982	2.006	2.029	2.051	2.072	2.092

LINEAR REGRESSION OF INPUT SP. GR. vS OUTPUT SP. GR.

or Pozzolan Sp. Gr. of 2.6

Regression Output:		
onstant		1.329611
td Err of Y Est		0.004779
Squared		0.989621
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.391688	
td Err of Coef.	0.003331	

or Pozzolan Sp. Gr. of 2.7

Regression Output:		
onstant		1.362244
td Err of Y Est		0.005065
Squared		0.988168
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.388573	
td Err of Coef.	0.003531	

or Pozzolan Sp. Gr. of 2.8

Regression Output:		
onstant		1.393827
td Err of Y Est		0.005349
Squared		0.986603
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.385316	
td Err of Coef.	0.003729	

or Pozzolan Sp. Gr. of 2.9

Regression Output:		
onstant		1.424406
td Err of Y Est		0.005629
Squared		0.984926
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.381943	
td Err of Coef.	0.003924	

or Pozzolan Sp. Gr. of 3.0

Regression Output:		
onstant		1.454023
td Err of Y Est		0.005905
Squared		0.983138
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.378477	
td Err of Coef.	0.004116	

or Pozzolan Sp. Gr. of 3.1

Regression Output:		
onstant		1.4827188
td Err of Y Est		0.0061761
Squared		0.9812389
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.374936	
td Err of Coef.	0.004305	

or Pozzolan Sp. Gr. of 3.2

Regression Output:		
onstant		1.5105332
td Err of Y Est		0.0064428
Squared		0.9792286
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.371338	
td Err of Coef.	0.004491	

or Pozzolan Sp. Gr. of 3.3

Regression Output:		
onstant		1.5375030
td Err of Y Est		0.0067047
Squared		0.9771076
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.367695	
td Err of Coef.	0.004674	

or Pozzolan Sp. Gr. of 3.4

Regression Output:		
onstant		1.563664
td Err of Y Est		0.006962
Squared		0.974876
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.364022	
td Err of Coef.	0.004853	

POZZOLAN SPECIFIC GRAVITY	X COEFF-ICIENT m	Y INTER-CEPT c
2.6	0.3916882	1.3296114
2.7	0.3885728	1.3622442
2.8	0.3853160	1.3938274
2.9	0.3819434	1.4244059
3.0	0.3784771	1.4540227
3.1	0.3749363	1.4827188
3.2	0.3713376	1.5105332
3.3	0.3676955	1.5375030
3.4	0.3640225	1.5636636

LINEAR REGRESSION OF X COEFFICIENT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:		
onstant		0.482350
td Err of Y Est		0.000262
Squared		0.999337
o. of Observations		9
egrees of Freedom		7
Coefficient(s)	-0.034710	
td Err of Coef.	0.000338	

LINEAR REGRESSION OF Y INTERCEPT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:		
onstant		0.574093
td Err of Y Est		0.003063
Squared		0.998720
o. of Observations		9
egrees of Freedom		7
Coefficient(s)	0.292285	
td Err of Coef.	0.003956	

TABLE G-8

T PRODUCT SPECIFIC GRAVITIES FOR DIFFERENT TDS & TSS CONDITIONS FOR A WATER TO POZZOLAN RA 0.48

PECIFIC GRAVITY OF POZZOLANS	2.600	2.70	2.80	2.90	3.00	3.10	3.20	3.30	3.40
PECIFIC GRAVITY OF SALT	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251
PECIFIC GRAVITY OF SILT	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23
W/P RATIO	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48

TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.
0	0	0.00	0	1.000	1.712	1.740	1.768	1.794	1.820	1.844	1.868	1.890	1.912
0	2.5	0.00	2.5	1.014	1.715	1.744	1.771	1.797	1.822	1.847	1.870	1.892	1.914
0	5	0.00	5	1.028	1.718	1.747	1.774	1.800	1.825	1.849	1.873	1.895	1.916
0	7.5	0.00	7.5	1.043	1.722	1.750	1.777	1.803	1.828	1.852	1.875	1.898	1.919
0	10	0.00	10	1.058	1.726	1.754	1.781	1.807	1.831	1.855	1.878	1.900	1.921
0	12.5	0.00	12.5	1.074	1.730	1.758	1.784	1.810	1.835	1.858	1.881	1.903	1.924
0	15	0.00	15	1.090	1.734	1.761	1.788	1.813	1.838	1.861	1.884	1.906	1.927
2	0	2.00	0	1.014	1.717	1.746	1.773	1.800	1.825	1.849	1.873	1.895	1.917
2	2.5	1.95	2.5	1.028	1.720	1.749	1.776	1.803	1.828	1.852	1.875	1.898	1.919
2	5	1.90	5	1.042	1.724	1.752	1.779	1.806	1.831	1.855	1.878	1.900	1.922
2	7.5	1.85	7.5	1.057	1.727	1.756	1.783	1.809	1.834	1.858	1.881	1.903	1.924
2	10	1.80	10	1.073	1.731	1.759	1.786	1.812	1.837	1.861	1.883	1.905	1.927
2	12.5	1.75	12.5	1.088	1.735	1.763	1.790	1.815	1.840	1.864	1.886	1.908	1.929
2	15	1.70	15	1.104	1.739	1.767	1.793	1.819	1.843	1.867	1.889	1.911	1.932
4	0	4.00	0	1.028	1.723	1.751	1.779	1.805	1.830	1.855	1.878	1.901	1.922
4	2.5	3.90	2.5	1.043	1.726	1.754	1.782	1.808	1.833	1.857	1.881	1.903	1.925
4	5	3.80	5	1.057	1.729	1.758	1.785	1.811	1.836	1.860	1.883	1.906	1.927
4	7.5	3.70	7.5	1.072	1.733	1.761	1.788	1.814	1.839	1.863	1.886	1.908	1.929
4	10	3.60	10	1.087	1.737	1.765	1.792	1.817	1.842	1.866	1.889	1.911	1.932
4	12.5	3.50	12.5	1.103	1.741	1.769	1.795	1.821	1.845	1.869	1.892	1.914	1.935
4	15	3.40	15	1.119	1.745	1.772	1.799	1.824	1.849	1.872	1.895	1.916	1.937
6	0	6.00	0	1.043	1.728	1.757	1.784	1.811	1.836	1.860	1.884	1.906	1.928
6	2.5	5.85	2.5	1.057	1.732	1.760	1.787	1.814	1.839	1.863	1.886	1.909	1.930
6	5	5.70	5	1.072	1.735	1.764	1.791	1.817	1.842	1.866	1.889	1.911	1.933
6	7.5	5.55	7.5	1.087	1.739	1.767	1.794	1.820	1.845	1.869	1.892	1.914	1.935
6	10	5.40	10	1.102	1.743	1.771	1.797	1.823	1.848	1.872	1.894	1.916	1.937
6	12.5	5.25	12.5	1.118	1.746	1.774	1.801	1.827	1.851	1.875	1.897	1.919	1.940
6	15	5.10	15	1.134	1.751	1.778	1.805	1.830	1.855	1.878	1.900	1.922	1.943
8	0	8.00	0	1.059	1.734	1.763	1.790	1.817	1.842	1.866	1.890	1.912	1.934
8	2.5	7.80	2.5	1.073	1.738	1.766	1.793	1.820	1.845	1.869	1.892	1.914	1.936
8	5	7.60	5	1.087	1.741	1.769	1.797	1.823	1.848	1.872	1.895	1.917	1.938
8	7.5	7.40	7.5	1.102	1.745	1.773	1.800	1.826	1.851	1.874	1.897	1.919	1.941
8	10	7.20	10	1.117	1.749	1.777	1.803	1.829	1.854	1.877	1.900	1.922	1.943
8	12.5	7.00	12.5	1.133	1.752	1.780	1.807	1.833	1.857	1.881	1.903	1.925	1.946
8	15	6.80	15	1.149	1.757	1.784	1.811	1.836	1.860	1.884	1.906	1.928	1.948
10	0	10.00	0	1.074	1.740	1.769	1.796	1.823	1.848	1.872	1.896	1.918	1.940
10	2.5	9.75	2.5	1.088	1.744	1.772	1.800	1.826	1.851	1.875	1.898	1.920	1.942
10	5	9.50	5	1.103	1.747	1.776	1.803	1.829	1.854	1.878	1.901	1.923	1.944
10	7.5	9.25	7.5	1.118	1.751	1.779	1.806	1.832	1.857	1.881	1.903	1.925	1.947
10	10	9.00	10	1.133	1.755	1.783	1.810	1.835	1.860	1.883	1.906	1.928	1.949
10	12.5	8.75	12.5	1.149	1.759	1.786	1.813	1.839	1.863	1.887	1.909	1.931	1.952
10	15	8.50	15	1.165	1.763	1.790	1.817	1.842	1.866	1.890	1.912	1.934	1.954
12	0	12.00	0	1.091	1.747	1.775	1.803	1.829	1.854	1.878	1.902	1.924	1.946
12	2.5	11.70	2.5	1.105	1.750	1.779	1.806	1.832	1.857	1.881	1.904	1.927	1.948
12	5	11.40	5	1.119	1.754	1.782	1.809	1.835	1.860	1.884	1.907	1.929	1.950
12	7.5	11.10	7.5	1.134	1.757	1.785	1.812	1.838	1.863	1.887	1.910	1.932	1.953
12	10	10.80	10	1.149	1.761	1.789	1.816	1.842	1.866	1.890	1.912	1.934	1.955
12	12.5	10.50	12.5	1.165	1.765	1.793	1.819	1.845	1.869	1.893	1.915	1.937	1.958
12	15	10.20	15	1.181	1.769	1.797	1.823	1.849	1.873	1.896	1.918	1.940	1.960
14	0	14.00	0	1.107	1.753	1.782	1.809	1.836	1.861	1.885	1.908	1.931	1.952
14	2.5	13.65	2.5	1.121	1.757	1.785	1.812	1.839	1.864	1.888	1.911	1.933	1.954
14	5	13.30	5	1.136	1.760	1.789	1.816	1.842	1.866	1.890	1.913	1.935	1.957
14	7.5	12.95	7.5	1.151	1.764	1.792	1.819	1.845	1.869	1.893	1.916	1.938	1.959
14	10	12.60	10	1.166	1.768	1.796	1.822	1.848	1.873	1.896	1.919	1.941	1.962
14	12.5	12.25	12.5	1.182	1.772	1.800	1.826	1.852	1.876	1.899	1.922	1.943	1.964
14	15	11.90	15	1.198	1.776	1.803	1.830	1.855	1.879	1.902	1.925	1.946	1.967
16	0	16.00	0	1.125	1.760	1.789	1.816	1.842	1.868	1.892	1.915	1.937	1.959
16	2.5	15.60	2.5	1.139	1.764	1.792	1.819	1.845	1.870	1.894	1.917	1.940	1.961
16	5	15.20	5	1.153	1.767	1.795	1.822	1.848	1.873	1.897	1.920	1.942	1.963
16	7.5	14.80	7.5	1.168	1.771	1.799	1.826	1.852	1.876	1.900	1.923	1.945	1.966
16	10	14.40	10	1.183	1.775	1.803	1.829	1.855	1.879	1.903	1.925	1.947	1.968
16	12.5	14.00	12.5	1.199	1.779	1.806	1.833	1.858	1.883	1.906	1.928	1.950	1.971
16	15	13.60	15	1.215	1.783	1.810	1.837	1.862	1.886	1.909	1.931	1.953	1.973
18	0	18.00	0	1.142	1.767	1.796	1.823	1.849	1.875	1.899	1.922	1.944	1.966
18	2.5	17.55	2.5	1.156	1.771	1.799	1.826	1.852	1.877	1.901	1.924	1.947	1.968
18	5	17.10	5	1.171	1.774	1.803	1.830	1.855	1.880	1.904	1.927	1.949	1.970
18	7.5	16.65	7.5	1.186	1.778	1.806	1.833	1.859	1.883	1.907	1.930	1.951	1.972
18	10	16.20	10	1.201	1.782	1.810	1.836	1.862	1.886	1.910	1.932	1.954	1.975
18	12.5	15.75	12.5	1.217	1.786	1.814	1.840	1.865	1.890	1.913	1.935	1.957	1.977
18	15	15.30	15	1.233	1.790	1.818	1.844	1.869	1.893	1.916	1.938	1.960	1.980
20	0	20.00	0	1.161	1.775	1.803	1.831	1.857	1.882	1.906	1.929	1.951	1.973
20	2.5	19.50	2.5	1.175	1.778	1.807	1.834	1.860	1.885	1.909	1.932	1.954	1.975
20	5	19.00	5	1.189	1.782	1.810	1.837	1.863	1.888	1.911	1.934	1.956	1.977
20	7.5	18.50	7.5	1.204	1.786	1.814	1.840	1.866	1.891	1.914	1.937	1.959	1.980
20	10	18.00	10	1.219	1.789	1.817	1.844	1.869	1.894	1.917	1.940	1.961	1.982
20	12.5	17.50	12.5	1.235	1.793	1.821	1.847	1.873	1.897	1.920	1.942	1.964	1.984
20	15	17.00	15	1.251	1.798	1.825	1.851	1.876	1.900	1.923	1.945	1.967	1.987
22	0	22.00	0	1.180	1.782	1.811	1.838	1.864	1.889	1.913	1.937	1.959	1.980
22	2.5	21.45	2.5	1.194	1.786	1.814	1.841	1.867	1.892	1.916	1.939	1.961	1.982
22	5	20.90	5	1.208	1.790	1.818	1.845	1.870	1.895	1.919	1.942	1.964	1.985
22	7.5	20.35	7.5	1.223	1.793	1.821	1.848	1.874	1.898	1.922	1.944	1.966	1.987
22	10	19.80	10	1.238	1.797	1.825	1.851	1.877	1.901	1.925	1.947	1.969	1.989
22	12.5	19.25	12.5	1.253	1.801	1.829	1.855	1.880	1.904	1.928	1.950	1.971	1.992
22	15	18.70	15	1.269	1.805	1.833	1.859	1.884	1.908	1.931	1.953	1.974	1.994
24	0	24.00	0	1.199	1.791	1.819	1.846	1.872	1.897	1.921	1.944	1.967	1.988
24	2.5	23.40	2.5	1.213	1.794	1.822	1.849	1.875	1.900	1.924	1.947	1.969	1.990
24	5	22.80	5	1.228	1.798	1.826	1.853	1.878	1.903	1.927	1.949	1.971	1.992
24	7.5	22.20	7.5	1.242	1.801	1.829	1.856	1.881	1.906	1.929	1.952	1.974	1.995
24	10	21.60	10	1.257	1.805	1.833	1.859	1.885	1.909	1.932	1.955	1.976	1.997
24	12.5	21.00	12.5	1.273	1.809	1.837	1.863	1.888	1.912	1.935	1.958	1.979	1.999
24	15	20.40	15	1.289	1.813	1.841	1.867	1.892	1.916	1.938	1.960	1.982	2.002
26	0	26.00	0	1.220	1.799	1.827	1.854	1.881	1.905	1.929	1.953	1.975	1.996
26	2.5	25.35	2.5	1.234	1.802	1.831	1.858	1.883	1.908	1.932	1.955	1.977	1.998
26	5	24.70	5	1.248	1.806	1.834	1.861	1.887	1.911	1.935	1.957	1.979	2.000
26	7.5	24.05	7.5	1.262	1.810	1.838	1.864	1.890	1.914	1.938	1.960	1.982	2.002
26	10	23.40	10	1.277	1.814	1.841	1.868	1.893	1.917	1.940	1.963	1.984	2.005
26	12.5	22.75	12.5	1.293	1.818	1.845	1.871	1.896	1.920	1.943	1.966	1.987	2.007
26	15	22.10	15	1.308	1.822	1.849	1.875	1.900	1.924	1.947	1.968	1.989	2.010
28	0	28.00	0	1.240	1.808	1.836	1.863	1.889	1.914	1.938	1.961	1.983	2.004
28	2.5	27.30	2.5	1.254	1.811	1.839	1.866	1.892	1.917	1.941	1.963	1.985	2.006
28	5	26.60	5	1.269	1.815	1.843	1.869	1.895	1.920	1.943	1.966	1.988	2.009
28	7.5	25.90	7.5	1.283	1.818	1.846	1.873	1.898	1.923	1.946	1.968	1.990	2.011
28	10	25.20	10	1.298	1.822	1.850	1.876	1.901	1.926	1.949	1.971	1.992	2.013
28	12.5	24.50	12.5	1.313	1.826	1.854	1.880	1.905	1.929	1.952	1.974	1.995	2.015
28	15	23.80	15	1.329	1.830	1.858	1.884	1.908	1.932	1.955	1.977	1.998	2.018
30	0	30.00	0	1.262	1.817	1.845	1.872	1.898	1.923	1.947	1.970	1.992	2.013
30	2.5	29.25	2.5	1.276	1.820	1.848	1.875	1.901	1.926	1.949	1.972	1.994	2.015
30	5	28.50	5	1.290	1.824	1.852	1.878	1.904	1.929	1.952	1.975	1.996	2.017
30	7.5	27.75	7.5	1.305	1.828	1.855	1.882	1.907	1.931	1.955	1.977	1.999	2.019
30	10	27.00	10	1.319	1.831	1.859	1.885	1.910	1.935	1.958	1.980	2.001	2.022
30	12.5	26.25	12.5	1.335	1.835	1.863	1.889	1.914	1.938	1.961	1.983	2.004	2.024
30	15	25.50	15	1.350	1.840	1.867	1.892	1.917	1.941	1.964	1.985	2.006	2.026
32	0	32.00	0	1.285	1.826	1.855	1.882	1.907	1.932	1.956	1.979	2.001	2.022
32	2.5	31.20	2.5	1.298	1.830	1.858	1.885	1.910	1.935	1.959	1.981	2.003	2.024
32	5	30.40	5	1.312	1.833	1.861	1.888	1.913	1.938	1.961	1.984	2.005	2.026
32	7.5	29.60	7.5	1.327	1.837	1.865	1.891	1.916	1.941	1.964	1.986	2.008	2.028
32	10	28.80	10	1.342	1.841	1.868	1.895	1.920	1.944	1.967	1.989	2.010	2.030
32	12.5	28.00	12.5	1.357	1.845	1.872	1.898	1.923	1.947	1.970	1.992	2.013	2.033
32	15	27.20	15	1.372	1.849	1.876	1.902	1.926	1.950	1.973	1.994	2.015	2.035
34	0	34.00	0	1.308	1.836	1.864	1.891	1.917	1.942	1.966	1.989	2.011	2.032
34	2.5	33.15	2.5	1.322	1.840	1.868	1.895	1.920	1.945	1.969	1.991	2.013	2.034
34	5	32.30	5	1.336	1.843	1.871	1.898	1.923	1.948	1.971	1.993	2.015	2.036
34	7.5	31.45	7.5	1.350	1.847	1.875	1.901	1.926	1.950	1.974	1.996	2.017	2.038
34	10	30.60	10	1.364	1.851	1.878	1.904	1.929	1.953	1.976	1.998	2.019	2.040
34	12.5	29.75	12.5	1.379	1.855	1.882	1.908	1.933	1.956	1.979	2.001	2.022	2.042
34	15	28.90	15	1.394	1.859	1.886	1.912	1.936	1.960	1.982	2.004	2.024	2.044
36	0	36.00	0	1.332	1.847	1.875	1.902	1.928	1.952	1.976	1.999	2.021	2.042
36	2.5	35.10	2.5	1.346	1.850	1.878	1.905	1.930	1.955	1.978	2.001	2.023	2.043
36	5	34.20	5	1.359	1.854	1.881	1.908	1.933	1.958	1.981	2.003	2.025	2.045
36	7.5	33.30	7.5	1.374	1.857	1.885	1.911	1.936	1.960	1.984	2.006	2.027	2.047
36	10	32.40	10	1.388	1.861	1.888	1.915	1.940	1.963	1.986	2.008	2.029	2.049
36	12.5	31.50	12.5	1.403	1.865	1.892	1.918	1.943	1.966	1.989	2.011	2.032	2.052
36	15	30.60	15	1.418	1.869	1.896	1.922	1.946	1.970	1.992	2.013	2.034	2.054
38	0	38.00	0	1.357	1.858	1.886	1.913	1.938	1.963	1.987	2.009	2.031	2.052
38	2.5	37.05	2.5	1.370	1.861	1.889	1.916	1.941	1.966	1.989	2.011	2.033	2.054
38	5	36.10	5	1.384	1.865	1.892	1.919	1.944	1.968	1.991	2.014	2.035	2.056
38	7.5	35.15	7.5	1.398	1.868	1.896	1.922	1.947	1.971	1.994	2.016	2.037	2.058
38	10	34.20	10	1.412	1.872	1.899	1.925	1.950	1.974	1.997	2.019	2.039	2.060
38	12.5	33.25	12.5	1.427	1.876	1.903	1.929	1.953	1.977	1.999	2.021	2.042	2.062
38	15	32.30	15	1.442	1.880	1.907	1.932	1.957	1.980	2.002	2.024	2.044	2.064
40	0	40.00	0	1.383	1.869	1.897	1.924	1.950	1.974	1.998	2.020	2.042	2.063
40	2.5	39.00	2.5	1.396	1.872	1.900	1.927	1.952	1.977	2.000	2.023	2.044	2.065
40	5	38.00	5	1.410	1.876	1.904	1.930	1.955	1.979	2.003	2.025	2.046	2.066
40	7.5	37.00	7.5	1.424	1.880	1.907	1.933	1.958	1.982	2.005	2.027	2.048	2.068
40	10	36.00	10	1.438	1.883	1.911	1.936	1.961	1.985	2.008	2.029	2.050	2.070
40	12.5	35.00	12.5	1.452	1.887	1.914	1.940	1.964	1.988	2.010	2.032	2.052	2.072
40	15	34.00	15	1.467	1.891	1.918	1.943	1.968	1.991	2.013	2.034	2.055	2.074

LINEAR REGRESSION OF INPUT SP. GR. vS OUTPUT SP. GR.

or Pozzolan Sp. Gr. of 2.6

Regression Output:

onstant		1.301134
td Err of Y Est		0.004750
Squared		0.990321
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.403312	
td Err of Coef.	0.003311	

or Pozzolan Sp. Gr. of 2.7

Regression Output:

onstant		1.332620
td Err of Y Est		0.005030
Squared		0.988998
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.400368	
td Err of Coef.	0.003507	

or Pozzolan Sp. Gr. of 2.8

Regression Output:

onstant		1.363068
td Err of Y Est		0.005308
Squared		0.987579
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.397288	
td Err of Coef.	0.003700	

or Pozzolan Sp. Gr. of 2.9

Regression Output:

onstant		1.392525
td Err of Y Est		0.005581
Squared		0.986065
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.394098	
td Err of Coef.	0.003891	

or Pozzolan Sp. Gr. of 3.0

Regression Output:

onstant		1.421033
td Err of Y Est		0.005850
Squared		0.984456
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.390819	
td Err of Coef.	0.004078	

or Pozzolan Sp. Gr. of 3.1

Regression Output:

onstant		1.4486354
td Err of Y Est		0.0061147
Squared		0.9827537
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.387470	
td Err of Coef.	0.004263	

or Pozzolan Sp. Gr. of 3.2

Regression Output:

onstant		1.4753702
td Err of Y Est		0.0063744
Squared		0.9809587
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.384066	
td Err of Coef.	0.004444	

or Pozzolan Sp. Gr. of 3.3

Regression Output:

onstant		1.5012754953818
td Err of Y Est		0.0066292179692051
Squared		0.97907220136528
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.380622	
td Err of Coef.	0.004621	

or Pozzolan Sp. Gr. of 3.4

Regression Output:

onstant		1.526387
td Err of Y Est		0.006879
Squared		0.977095
o. of Observations		147
egrees of Freedom		145
Coefficient(s)	0.377150	
td Err of Coef.	0.004795	

POZZOLAN SPECIFIC GRAVITY	X COEFF-ICIENT m	Y INTER-CEPT c
2.6	0.4033121	1.3011340
2.7	0.4003677	1.3326200
2.8	0.3972881	1.3630683
2.9	0.3940979	1.3925250
3.0	0.3908189	1.4210335
3.1	0.3874695	1.4486354
3.2	0.3840659	1.4753702
3.3	0.3806220	1.5012755
3.4	0.3771497	1.5263868

LINEAR REGRESSION OF X COEFFICIENT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

onstant		0.489057
td Err of Y Est		0.000248
Squared		0.999336
o. of Observations		9
egrees of Freedom		7
Coefficient(s)	-0.032827	
td Err of Coef.	0.000320	

LINEAR REGRESSION OF Y INTERCEPT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

onstant		0.574159
td Err of Y Est		0.003017
Squared		0.998660
o. of Observations		9
egrees of Freedom		7
Coefficient(s)	0.281282	
td Err of Coef.	0.003695	

TABLE G-9

C T PRODUCT SPECIFIC GRAVITIES FOR DIFFERENT TDS & TSS CONDITIONS FOR A WATER TO POZZOLAN RA 0.50

SPECIFIC GRAVITY OF POZZOLANS					2.600	2.70	2.80	2.90	3.00	3.10	3.20	3.30	3.40
SPECIFIC GRAVITY OF SALT					3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251
SPECIFIC GRAVITY OF SILT					2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23
W/P RATIO					0.5	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
TDS %	TSS %	SALT %	SILT %	INPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.
0	0	0.00	0	1.000	1.696	1.723	1.750	1.776	1.800	1.824	1.846	1.868	1.889
0	2.5	0.00	2.5	1.014	1.699	1.727	1.753	1.779	1.803	1.826	1.849	1.870	1.891
0	5	0.00	5	1.028	1.703	1.730	1.757	1.782	1.806	1.829	1.852	1.873	1.894
0	7.5	0.00	7.5	1.043	1.706	1.734	1.760	1.785	1.809	1.832	1.855	1.876	1.897
0	10	0.00	10	1.058	1.710	1.738	1.764	1.789	1.812	1.835	1.858	1.879	1.899
0	12.5	0.00	12.5	1.074	1.714	1.741	1.767	1.792	1.816	1.839	1.861	1.882	1.902
0	15	0.00	15	1.090	1.719	1.745	1.771	1.796	1.819	1.842	1.864	1.885	1.905
2	0	2.00	0	1.014	1.701	1.729	1.755	1.781	1.805	1.829	1.852	1.873	1.894
2	2.5	1.95	2.5	1.028	1.705	1.732	1.759	1.784	1.808	1.832	1.854	1.876	1.897
2	5	1.90	5	1.042	1.708	1.736	1.762	1.787	1.811	1.835	1.857	1.879	1.899
2	7.5	1.85	7.5	1.057	1.712	1.739	1.765	1.791	1.815	1.838	1.860	1.881	1.902
2	10	1.80	10	1.073	1.716	1.743	1.769	1.794	1.818	1.841	1.863	1.884	1.905
2	12.5	1.75	12.5	1.088	1.720	1.747	1.773	1.798	1.821	1.844	1.866	1.887	1.907
2	15	1.70	15	1.104	1.724	1.751	1.777	1.801	1.825	1.848	1.869	1.890	1.910
4	0	4.00	0	1.028	1.707	1.735	1.761	1.787	1.811	1.835	1.857	1.879	1.900
4	2.5	3.90	2.5	1.043	1.710	1.738	1.764	1.790	1.814	1.837	1.860	1.881	1.902
4	5	3.80	5	1.057	1.714	1.741	1.768	1.793	1.817	1.840	1.863	1.884	1.905
4	7.5	3.70	7.5	1.072	1.718	1.745	1.771	1.796	1.820	1.843	1.866	1.887	1.907
4	10	3.60	10	1.087	1.722	1.749	1.775	1.800	1.824	1.847	1.869	1.890	1.910
4	12.5	3.50	12.5	1.103	1.726	1.753	1.779	1.803	1.827	1.850	1.872	1.893	1.913
4	15	3.40	15	1.119	1.730	1.757	1.782	1.807	1.831	1.853	1.875	1.896	1.916
6	0	6.00	0	1.043	1.713	1.740	1.767	1.792	1.817	1.840	1.863	1.885	1.906
6	2.5	5.85	2.5	1.057	1.716	1.744	1.770	1.796	1.820	1.843	1.866	1.887	1.908
6	5	5.70	5	1.072	1.720	1.747	1.774	1.799	1.823	1.846	1.868	1.890	1.911
6	7.5	5.55	7.5	1.087	1.724	1.751	1.777	1.802	1.826	1.849	1.871	1.893	1.913
6	10	5.40	10	1.102	1.728	1.755	1.781	1.806	1.829	1.852	1.874	1.896	1.916
6	12.5	5.25	12.5	1.118	1.732	1.759	1.785	1.809	1.833	1.856	1.878	1.899	1.919
6	15	5.10	15	1.134	1.736	1.763	1.788	1.813	1.837	1.859	1.881	1.902	1.922
8	0	8.00	0	1.059	1.719	1.747	1.773	1.799	1.823	1.846	1.869	1.891	1.911
8	2.5	7.80	2.5	1.073	1.722	1.750	1.776	1.802	1.826	1.849	1.872	1.893	1.914
8	5	7.60	5	1.087	1.726	1.753	1.780	1.805	1.829	1.852	1.874	1.896	1.916
8	7.5	7.40	7.5	1.102	1.730	1.757	1.783	1.808	1.832	1.855	1.877	1.899	1.919
8	10	7.20	10	1.117	1.734	1.761	1.787	1.812	1.836	1.858	1.880	1.901	1.922
8	12.5	7.00	12.5	1.133	1.738	1.765	1.791	1.815	1.839	1.862	1.884	1.904	1.925
8	15	6.80	15	1.149	1.742	1.769	1.795	1.819	1.843	1.865	1.887	1.908	1.928
10	0	10.00	0	1.074	1.725	1.753	1.779	1.805	1.829	1.853	1.875	1.897	1.918
10	2.5	9.75	2.5	1.088	1.729	1.756	1.783	1.808	1.832	1.855	1.878	1.899	1.920
10	5	9.50	5	1.103	1.732	1.760	1.786	1.811	1.835	1.858	1.881	1.902	1.923
10	7.5	9.25	7.5	1.118	1.736	1.763	1.790	1.815	1.838	1.861	1.884	1.905	1.925
10	10	9.00	10	1.133	1.740	1.767	1.793	1.818	1.842	1.865	1.887	1.908	1.928
10	12.5	8.75	12.5	1.149	1.744	1.771	1.797	1.822	1.845	1.868	1.890	1.911	1.931
10	15	8.50	15	1.165	1.749	1.775	1.801	1.825	1.849	1.871	1.893	1.914	1.934
12	0	12.00	0	1.091	1.732	1.759	1.786	1.811	1.836	1.859	1.882	1.903	1.924
12	2.5	11.70	2.5	1.105	1.735	1.763	1.789	1.814	1.839	1.862	1.884	1.906	1.926
12	5	11.40	5	1.119	1.739	1.766	1.793	1.818	1.842	1.865	1.887	1.908	1.929
12	7.5	11.10	7.5	1.134	1.743	1.770	1.796	1.821	1.845	1.868	1.890	1.911	1.932
12	10	10.80	10	1.149	1.747	1.774	1.800	1.825	1.848	1.871	1.893	1.914	1.934
12	12.5	10.50	12.5	1.165	1.751	1.778	1.804	1.828	1.852	1.874	1.896	1.917	1.937
12	15	10.20	15	1.181	1.755	1.782	1.807	1.832	1.855	1.878	1.899	1.920	1.940
14	0	14.00	0	1.107	1.738	1.766	1.793	1.818	1.842	1.866	1.888	1.910	1.931
14	2.5	13.65	2.5	1.121	1.742	1.770	1.796	1.821	1.845	1.869	1.891	1.912	1.933
14	5	13.30	5	1.136	1.746	1.773	1.799	1.824	1.848	1.871	1.894	1.915	1.935
14	7.5	12.95	7.5	1.151	1.750	1.777	1.803	1.828	1.852	1.875	1.897	1.918	1.938
14	10	12.60	10	1.166	1.754	1.781	1.807	1.831	1.855	1.878	1.900	1.921	1.941
14	12.5	12.25	12.5	1.182	1.758	1.785	1.810	1.835	1.858	1.881	1.903	1.924	1.944
14	15	11.90	15	1.198	1.762	1.789	1.814	1.839	1.862	1.884	1.906	1.927	1.946
16	0	16.00	0	1.125	1.746	1.773	1.800	1.825	1.849	1.873	1.895	1.917	1.937
16	2.5	15.60	2.5	1.139	1.749	1.777	1.803	1.828	1.852	1.875	1.898	1.919	1.940
16	5	15.20	5	1.153	1.753	1.780	1.806	1.831	1.855	1.878	1.901	1.922	1.942
16	7.5	14.80	7.5	1.168	1.757	1.784	1.810	1.835	1.859	1.881	1.903	1.925	1.945
16	10	14.40	10	1.183	1.761	1.788	1.814	1.838	1.862	1.885	1.906	1.927	1.948
16	12.5	14.00	12.5	1.199	1.765	1.792	1.817	1.842	1.865	1.888	1.910	1.930	1.950
16	15	13.60	15	1.215	1.769	1.796	1.821	1.846	1.869	1.891	1.913	1.933	1.953
18	0	18.00	0	1.142	1.753	1.780	1.807	1.832	1.856	1.880	1.902	1.924	1.944
18	2.5	17.55	2.5	1.156	1.756	1.784	1.810	1.835	1.859	1.883	1.905	1.926	1.947
18	5	17.10	5	1.171	1.760	1.787	1.814	1.839	1.863	1.886	1.908	1.929	1.949
18	7.5	16.65	7.5	1.186	1.764	1.791	1.817	1.842	1.866	1.889	1.911	1.932	1.952
18	10	16.20	10	1.201	1.768	1.795	1.821	1.846	1.869	1.892	1.914	1.934	1.955
18	12.5	15.75	12.5	1.217	1.772	1.799	1.825	1.849	1.873	1.895	1.917	1.937	1.957
18	15	15.30	15	1.233	1.777	1.803	1.829	1.853	1.876	1.898	1.920	1.940	1.960
20	0	20.00	0	1.161	1.760	1.788	1.814	1.840	1.864	1.887	1.910	1.931	1.952
20	2.5	19.50	2.5	1.175	1.764	1.792	1.818	1.843	1.867	1.890	1.912	1.934	1.954
20	5	19.00	5	1.189	1.768	1.795	1.821	1.846	1.870	1.893	1.915	1.936	1.957
20	7.5	18.50	7.5	1.204	1.772	1.799	1.825	1.850	1.873	1.896	1.918	1.939	1.959
20	10	18.00	10	1.219	1.776	1.803	1.828	1.853	1.877	1.899	1.921	1.942	1.962
20	12.5	17.50	12.5	1.235	1.780	1.807	1.832	1.857	1.880	1.903	1.924	1.945	1.965
20	15	17.00	15	1.251	1.784	1.811	1.836	1.860	1.884	1.906	1.927	1.948	1.967
22	0	22.00	0	1.180	1.768	1.796	1.822	1.848	1.872	1.895	1.917	1.939	1.959
22	2.5	21.45	2.5	1.194	1.772	1.799	1.826	1.851	1.875	1.898	1.920	1.941	1.962
22	5	20.90	5	1.208	1.776	1.803	1.829	1.854	1.878	1.901	1.923	1.944	1.964
22	7.5	20.35	7.5	1.223	1.780	1.807	1.833	1.857	1.881	1.904	1.926	1.947	1.967
22	10	19.80	10	1.238	1.784	1.811	1.836	1.861	1.884	1.907	1.929	1.949	1.969
22	12.5	19.25	12.5	1.253	1.788	1.815	1.840	1.864	1.888	1.910	1.932	1.952	1.972
22	15	18.70	15	1.269	1.792	1.819	1.844	1.868	1.891	1.914	1.935	1.955	1.975
24	0	24.00	0	1.199	1.777	1.804	1.830	1.856	1.880	1.903	1.925	1.947	1.967
24	2.5	23.40	2.5	1.213	1.780	1.808	1.834	1.859	1.883	1.906	1.928	1.949	1.970
24	5	22.80	5	1.228	1.784	1.811	1.837	1.862	1.886	1.909	1.931	1.952	1.972
24	7.5	22.20	7.5	1.242	1.788	1.815	1.841	1.865	1.889	1.912	1.934	1.955	1.975
24	10	21.60	10	1.257	1.792	1.819	1.844	1.869	1.892	1.915	1.937	1.957	1.977
24	12.5	21.00	12.5	1.273	1.796	1.823	1.848	1.873	1.896	1.918	1.940	1.960	1.980
24	15	20.40	15	1.289	1.801	1.827	1.852	1.876	1.899	1.922	1.943	1.963	1.983
26	0	26.00	0	1.220	1.785	1.813	1.839	1.864	1.888	1.912	1.934	1.955	1.976
26	2.5	25.35	2.5	1.234	1.789	1.816	1.842	1.867	1.891	1.914	1.936	1.958	1.978
26	5	24.70	5	1.248	1.793	1.820	1.846	1.871	1.894	1.917	1.939	1.960	1.980
26	7.5	24.05	7.5	1.262	1.797	1.824	1.849	1.874	1.898	1.920	1.942	1.963	1.983
26	10	23.40	10	1.277	1.801	1.827	1.853	1.877	1.901	1.923	1.945	1.966	1.985
26	12.5	22.75	12.5	1.293	1.805	1.831	1.857	1.881	1.904	1.927	1.948	1.968	1.988
26	15	22.10	15	1.308	1.809	1.836	1.861	1.885	1.908	1.930	1.951	1.971	1.991
28	0	28.00	0	1.240	1.794	1.822	1.848	1.873	1.897	1.920	1.942	1.964	1.984
28	2.5	27.30	2.5	1.254	1.798	1.825	1.851	1.876	1.900	1.923	1.945	1.966	1.987
28	5	26.60	5	1.269	1.802	1.829	1.855	1.879	1.903	1.926	1.948	1.969	1.989
28	7.5	25.90	7.5	1.283	1.806	1.832	1.858	1.883	1.906	1.929	1.951	1.971	1.991
28	10	25.20	10	1.298	1.810	1.836	1.862	1.886	1.910	1.932	1.953	1.974	1.994
28	12.5	24.50	12.5	1.313	1.814	1.840	1.866	1.890	1.913	1.935	1.956	1.977	1.996
28	15	23.80	15	1.329	1.818	1.844	1.870	1.894	1.916	1.938	1.960	1.980	1.999
30	0	30.00	0	1.262	1.804	1.831	1.857	1.882	1.906	1.929	1.952	1.973	1.993
30	2.5	29.25	2.5	1.276	1.807	1.834	1.860	1.885	1.909	1.932	1.954	1.975	1.996
30	5	28.50	5	1.290	1.811	1.838	1.864	1.889	1.912	1.935	1.957	1.978	1.998
30	7.5	27.75	7.5	1.305	1.815	1.842	1.867	1.892	1.915	1.938	1.960	1.980	2.000
30	10	27.00	10	1.319	1.819	1.846	1.871	1.895	1.919	1.941	1.962	1.983	2.003
30	12.5	26.25	12.5	1.335	1.823	1.850	1.875	1.899	1.922	1.944	1.965	1.986	2.005
30	15	25.50	15	1.350	1.827	1.854	1.879	1.903	1.925	1.947	1.968	1.989	2.008
32	0	32.00	0	1.285	1.813	1.841	1.867	1.892	1.916	1.939	1.961	1.982	2.003
32	2.5	31.20	2.5	1.298	1.817	1.844	1.870	1.895	1.919	1.942	1.964	1.985	2.005
32	5	30.40	5	1.312	1.821	1.848	1.874	1.898	1.922	1.945	1.966	1.987	2.007
32	7.5	29.60	7.5	1.327	1.825	1.851	1.877	1.902	1.925	1.947	1.969	1.990	2.009
32	10	28.80	10	1.342	1.829	1.855	1.881	1.905	1.928	1.950	1.972	1.992	2.012
32	12.5	28.00	12.5	1.357	1.833	1.859	1.884	1.908	1.931	1.954	1.975	1.995	2.014
32	15	27.20	15	1.372	1.837	1.863	1.888	1.912	1.935	1.957	1.978	1.998	2.017
34	0	34.00	0	1.308	1.824	1.851	1.877	1.902	1.926	1.949	1.971	1.992	2.012
34	2.5	33.15	2.5	1.322	1.827	1.854	1.880	1.905	1.929	1.952	1.973	1.994	2.015
34	5	32.30	5	1.336	1.831	1.858	1.884	1.908	1.932	1.954	1.976	1.997	2.017
34	7.5	31.45	7.5	1.350	1.835	1.862	1.887	1.912	1.935	1.957	1.979	1.999	2.019
34	10	30.60	10	1.364	1.839	1.865	1.891	1.915	1.938	1.960	1.981	2.002	2.021
34	12.5	29.75	12.5	1.379	1.843	1.869	1.894	1.918	1.941	1.963	1.984	2.005	2.024
34	15	28.90	15	1.394	1.847	1.873	1.898	1.922	1.945	1.966	1.987	2.007	2.026
36	0	36.00	0	1.332	1.834	1.862	1.888	1.913	1.936	1.959	1.981	2.002	2.023
36	2.5	35.10	2.5	1.346	1.838	1.865	1.891	1.916	1.939	1.962	1.984	2.005	2.025
36	5	34.20	5	1.359	1.842	1.868	1.894	1.919	1.942	1.965	1.986	2.007	2.027
36	7.5	33.30	7.5	1.374	1.845	1.872	1.898	1.922	1.945	1.968	1.989	2.009	2.029
36	10	32.40	10	1.388	1.849	1.876	1.901	1.925	1.948	1.970	1.992	2.012	2.031
36	12.5	31.50	12.5	1.403	1.854	1.880	1.905	1.929	1.952	1.973	1.994	2.015	2.034
36	15	30.60	15	1.418	1.858	1.884	1.909	1.932	1.955	1.977	1.997	2.017	2.036
38	0	38.00	0	1.357	1.845	1.873	1.899	1.924	1.947	1.970	1.992	2.013	2.033
38	2.5	37.05	2.5	1.370	1.849	1.876	1.902	1.927	1.950	1.973	1.995	2.015	2.035
38	5	36.10	5	1.384	1.853	1.880	1.905	1.930	1.953	1.976	1.997	2.018	2.038
38	7.5	35.15	7.5	1.398	1.857	1.883	1.909	1.933	1.956	1.978	2.000	2.020	2.040
38	10	34.20	10	1.412	1.861	1.887	1.912	1.936	1.959	1.981	2.002	2.023	2.042
38	12.5	33.25	12.5	1.427	1.865	1.891	1.916	1.940	1.962	1.984	2.005	2.025	2.044
38	15	32.30	15	1.442	1.869	1.895	1.920	1.943	1.966	1.987	2.008	2.028	2.047
40	0	40.00	0	1.383	1.857	1.884	1.910	1.935	1.959	1.982	2.004	2.025	2.045
40	2.5	39.00	2.5	1.396	1.861	1.888	1.914	1.938	1.962	1.984	2.006	2.027	2.047
40	5	38.00	5	1.410	1.864	1.891	1.917	1.941	1.965	1.987	2.008	2.029	2.049
40	7.5	37.00	7.5	1.424	1.868	1.895	1.920	1.944	1.967	1.990	2.011	2.031	2.051
40	10	36.00	10	1.438	1.872	1.899	1.924	1.948	1.970	1.992	2.013	2.034	2.053
40	12.5	35.00	12.5	1.452	1.876	1.902	1.927	1.951	1.974	1.995	2.016	2.036	2.055
40	15	34.00	15	1.467	1.881	1.906	1.931	1.954	1.977	1.998	2.019	2.038	2.057

LINEAR REGRESSION OF INPUT SP. GR. vS OUTPUT SP. GR.

or Pozzolan Sp. Gr. of 2.6

Regression Output:		
onstant		1.273829
td Err of Y Est		0.004719
R Squared		0.990953
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.414532	
td Err of Coef.	0.003289	

or Pozzolan Sp. Gr. of 2.7

Regression Output:		
onstant		1.304234
td Err of Y Est		0.004993
R Squared		0.989744
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.411751	
td Err of Coef.	0.003481	

or Pozzolan Sp. Gr. of 2.8

Regression Output:		
onstant		1.333614
td Err of Y Est		0.005264
R Squared		0.988452
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.408840	
td Err of Coef.	0.003670	

or Pozzolan Sp. Gr. of 2.9

Regression Output:		
onstant		1.362015
td Err of Y Est		0.005531
R Squared		0.987079
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.405823	
td Err of Coef.	0.003856	

or Pozzolan Sp. Gr. of 3.0

Regression Output:		
onstant		1.389482
td Err of Y Est		0.005794
R Squared		0.985625
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.402721	
td Err of Coef.	0.004039	

or Pozzolan Sp. Gr. of 3.1

Regression Output:		
onstant		1.4160568
td Err of Y Est		0.0060517
R Squared		0.9840921
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.399553	
td Err of Coef.	0.004219	

or Pozzolan Sp. Gr. of 3.2

Regression Output:		
onstant		1.4417794
td Err of Y Est		0.0063047
R Squared		0.9824815
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.396334	
td Err of Coef.	0.004395	

or Pozzolan Sp. Gr. of 3.3

Regression Output:		
onstant		1.4666875
td Err of Y Est		0.0065526
R Squared		0.9807948
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.393077	
td Err of Coef.	0.004568	

or Pozzolan Sp. Gr. of 3.4

Regression Output:		
onstant		1.490817
td Err of Y Est		0.006795
R Squared		0.979033
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.389794	
td Err of Coef.	0.004737	

POZZOLAN SPECIFIC GRAVITY	X COEFF-ICIENT m	Y INTER-CEPT c
2.6	0.4145319	1.2738294
2.7	0.4117506	1.3042340
2.8	0.4088395	1.3336136
2.9	0.4058228	1.3620148
3.0	0.4027214	1.3894819
3.1	0.3995533	1.4160568
3.2	0.3963341	1.4417794
3.3	0.3930773	1.4666875
3.4	0.3897944	1.4908169

LINEAR REGRESSION OF X COEFFICIENT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:		
onstant		0.495617
td Err of Y Est		0.000235
R Squared		0.999330
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	-0.031042	
td Err of Coef.	0.000304	

LINEAR REGRESSION OF Y INTERCEPT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:		
onstant		0.573660
td Err of Y Est		0.002870
R Squared		0.998600
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	0.270947	
td Err of Coef.	0.003834	

TABLE Q-14

207C/CLARIFIER

OUTPUT PRODUCT SPECIFIC GRAVITIES FOR DIFFERENT TDS & TSS CONDITIONS FOR A WATER TO POZZOLAN RATI[illegible]2

WITH CLARIFIER SILT AS PERCENTAGE OF TOTAL SILT = 0%

SPECIFIC GRAVITY OF POZZOLANS						2.600	2.70	2.80	2.90	3.00	3.10	3.20	3.30	3.40
SPECIFIC GRAVITY OF SALT						3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251
SPECIFIC GRAVITY OF SILT						2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23
SPECIFIC GRAVITY OF CLAR. SILT						2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73
W/P RATIO						0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
C(%)						0	0	0	0	0	0	0	0	0
TDS %	TSS %	SALT %	CLAR SILT	SILT	INPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.
0	0	0.00	0	0	1.000	1.765	1.797	1.827	1.857	1.885	1.912	1.939	1.964	1.988
0	2.5	0.00	0	2.5	1.014	1.768	1.799	1.830	1.859	1.887	1.914	1.940	1.966	1.990
0	5	0.00	0	5	1.028	1.770	1.802	1.832	1.861	1.889	1.916	1.942	1.968	1.992
0	7.5	0.00	0	7.5	1.043	1.773	1.805	1.835	1.864	1.892	1.919	1.945	1.969	1.994
0	10	0.00	0	10	1.058	1.777	1.808	1.838	1.867	1.894	1.921	1.947	1.971	1.995
0	12.5	0.00	0	12.5	1.074	1.780	1.811	1.841	1.869	1.897	1.923	1.949	1.974	1.997
0	15	0.00	0	15	1.090	1.783	1.814	1.844	1.872	1.900	1.926	1.951	1.976	1.999
2	0	2.00	0	0	1.014	1.770	1.801	1.832	1.861	1.890	1.917	1.943	1.969	1.993
2	2.5	1.95	0	2.5	1.028	1.772	1.804	1.835	1.864	1.892	1.919	1.945	1.970	1.995
2	5	1.90	0	5	1.042	1.775	1.807	1.837	1.866	1.894	1.921	1.947	1.972	1.996
2	7.5	1.85	0	7.5	1.057	1.778	1.810	1.840	1.869	1.897	1.923	1.949	1.974	1.998
2	10	1.80	0	10	1.073	1.782	1.813	1.843	1.871	1.899	1.926	1.951	1.976	2.000
2	12.5	1.75	0	12.5	1.088	1.785	1.816	1.846	1.874	1.902	1.928	1.954	1.978	2.002
2	15	1.70	0	15	1.104	1.788	1.819	1.849	1.877	1.904	1.931	1.956	1.980	2.004
4	0	4.00	0	0	1.028	1.775	1.806	1.837	1.866	1.895	1.922	1.948	1.973	1.998
4	2.5	3.90	0	2.5	1.043	1.778	1.809	1.840	1.869	1.897	1.924	1.950	1.975	2.000
4	5	3.80	0	5	1.057	1.780	1.812	1.842	1.871	1.899	1.926	1.952	1.977	2.001
4	7.5	3.70	0	7.5	1.072	1.783	1.815	1.845	1.874	1.902	1.928	1.954	1.979	2.003
4	10	3.60	0	10	1.087	1.787	1.818	1.848	1.876	1.904	1.931	1.956	1.981	2.005
4	12.5	3.50	0	12.5	1.103	1.790	1.821	1.851	1.879	1.907	1.933	1.958	1.983	2.007
4	15	3.40	0	15	1.119	1.793	1.824	1.854	1.882	1.909	1.936	1.961	1.985	2.009
6	0	6.00	0	0	1.043	1.780	1.812	1.842	1.872	1.900	1.927	1.953	1.978	2.003
6	2.5	5.85	0	2.5	1.057	1.783	1.814	1.845	1.874	1.902	1.929	1.955	1.980	2.004
6	5	5.70	0	5	1.072	1.786	1.817	1.847	1.876	1.904	1.931	1.957	1.982	2.006
6	7.5	5.55	0	7.5	1.087	1.789	1.820	1.850	1.879	1.907	1.933	1.959	1.984	2.008
6	10	5.40	0	10	1.102	1.792	1.823	1.853	1.882	1.909	1.936	1.961	1.986	2.010
6	12.5	5.25	0	12.5	1.118	1.795	1.826	1.856	1.884	1.912	1.938	1.963	1.988	2.012
6	15	5.10	0	15	1.134	1.799	1.829	1.859	1.887	1.914	1.941	1.966	1.990	2.013
8	0	8.00	0	0	1.059	1.785	1.817	1.847	1.877	1.905	1.932	1.958	1.984	2.008
8	2.5	7.80	0	2.5	1.073	1.788	1.820	1.850	1.879	1.907	1.934	1.960	1.985	2.010
8	5	7.60	0	5	1.087	1.791	1.822	1.853	1.882	1.910	1.936	1.962	1.987	2.011
8	7.5	7.40	0	7.5	1.102	1.794	1.825	1.855	1.884	1.912	1.939	1.964	1.989	2.013
8	10	7.20	0	10	1.117	1.797	1.828	1.858	1.887	1.914	1.941	1.966	1.991	2.015
8	12.5	7.00	0	12.5	1.133	1.801	1.832	1.861	1.890	1.917	1.943	1.969	1.993	2.017
8	15	6.80	0	15	1.149	1.804	1.835	1.864	1.893	1.920	1.946	1.971	1.995	2.019
10	0	10.00	0	0	1.074	1.791	1.823	1.853	1.882	1.910	1.938	1.964	1.989	2.013
10	2.5	9.75	0	2.5	1.088	1.794	1.825	1.856	1.885	1.913	1.940	1.966	1.991	2.015
10	5	9.50	0	5	1.103	1.797	1.828	1.858	1.887	1.915	1.942	1.968	1.993	2.017
10	7.5	9.25	0	7.5	1.118	1.800	1.831	1.861	1.890	1.917	1.944	1.970	1.994	2.018
10	10	9.00	0	10	1.133	1.803	1.834	1.864	1.892	1.920	1.946	1.972	1.996	2.020
10	12.5	8.75	0	12.5	1.149	1.806	1.837	1.867	1.895	1.922	1.949	1.974	1.998	2.022
10	15	8.50	0	15	1.165	1.810	1.840	1.870	1.898	1.925	1.951	1.976	2.001	2.024
12	0	12.00	0	0	1.091	1.797	1.828	1.859	1.888	1.916	1.943	1.969	1.995	2.019
12	2.5	11.70	0	2.5	1.105	1.800	1.831	1.861	1.890	1.918	1.945	1.971	1.996	2.020
12	5	11.40	0	5	1.119	1.803	1.834	1.864	1.893	1.921	1.947	1.973	1.998	2.022
12	7.5	11.10	0	7.5	1.134	1.806	1.837	1.867	1.895	1.923	1.950	1.975	2.000	2.024
12	10	10.80	0	10	1.149	1.809	1.840	1.870	1.898	1.926	1.952	1.977	2.002	2.026
12	12.5	10.50	0	12.5	1.165	1.812	1.843	1.873	1.901	1.928	1.954	1.980	2.004	2.027
12	15	10.20	0	15	1.181	1.816	1.846	1.876	1.904	1.931	1.957	1.982	2.006	2.029
14	0	14.00	0	0	1.107	1.803	1.834	1.865	1.894	1.922	1.949	1.975	2.000	2.025
14	2.5	13.65	0	2.5	1.121	1.806	1.837	1.867	1.896	1.924	1.951	1.977	2.002	2.026
14	5	13.30	0	5	1.136	1.809	1.840	1.870	1.899	1.927	1.953	1.979	2.004	2.028
14	7.5	12.95	0	7.5	1.151	1.812	1.843	1.873	1.901	1.929	1.956	1.981	2.006	2.029
14	10	12.60	0	10	1.166	1.815	1.846	1.876	1.904	1.931	1.958	1.983	2.008	2.031
14	12.5	12.25	0	12.5	1.182	1.818	1.849	1.878	1.907	1.934	1.960	1.985	2.010	2.033
14	15	11.90	0	15	1.198	1.822	1.852	1.882	1.910	1.937	1.963	1.988	2.012	2.035
16	0	16.00	0	0	1.125	1.809	1.841	1.871	1.900	1.928	1.955	1.981	2.006	2.031
16	2.5	15.60	0	2.5	1.139	1.812	1.843	1.873	1.902	1.930	1.957	1.983	2.008	2.032
16	5	15.20	0	5	1.153	1.815	1.846	1.876	1.905	1.933	1.959	1.985	2.010	2.034
16	7.5	14.80	0	7.5	1.168	1.818	1.849	1.879	1.908	1.935	1.962	1.987	2.012	2.035
16	10	14.40	0	10	1.183	1.821	1.852	1.882	1.910	1.938	1.964	1.989	2.014	2.037
16	12.5	14.00	0	12.5	1.199	1.825	1.855	1.885	1.913	1.940	1.966	1.991	2.016	2.039
16	15	13.60	0	15	1.215	1.828	1.859	1.888	1.916	1.943	1.969	1.994	2.018	2.041
18	0	18.00	0	0	1.142	1.815	1.847	1.877	1.906	1.935	1.961	1.987	2.013	2.037
18	2.5	17.55	0	2.5	1.156	1.818	1.850	1.880	1.909	1.937	1.964	1.989	2.014	2.038
18	5	17.10	0	5	1.171	1.821	1.853	1.883	1.911	1.939	1.966	1.991	2.016	2.040
18	7.5	16.65	0	7.5	1.186	1.824	1.856	1.885	1.914	1.941	1.968	1.993	2.018	2.041
18	10	16.20	0	10	1.201	1.828	1.859	1.888	1.917	1.944	1.970	1.995	2.020	2.043
18	12.5	15.75	0	12.5	1.217	1.831	1.862	1.891	1.919	1.946	1.972	1.998	2.022	2.045
18	15	15.30	0	15	1.233	1.835	1.865	1.894	1.922	1.949	1.975	2.000	2.024	2.047
20	0	20.00	0	0	1.161	1.822	1.854	1.884	1.913	1.941	1.968	1.994	2.019	2.043
20	2.5	19.50	0	2.5	1.175	1.825	1.856	1.887	1.916	1.943	1.970	1.996	2.021	2.045
20	5	19.00	0	5	1.189	1.828	1.859	1.889	1.918	1.946	1.972	1.998	2.022	2.046
20	7.5	18.50	0	7.5	1.204	1.831	1.862	1.892	1.921	1.948	1.974	2.000	2.024	2.048
20	10	18.00	0	10	1.219	1.835	1.865	1.895	1.923	1.950	1.977	2.002	2.026	2.049
20	12.5	17.50	0	12.5	1.235	1.838	1.869	1.898	1.926	1.953	1.979	2.004	2.028	2.051
20	15	17.00	0	15	1.251	1.841	1.872	1.901	1.929	1.956	1.981	2.006	2.030	2.053
22	0	22.00	0	0	1.180	1.829	1.861	1.891	1.920	1.948	1.975	2.001	2.026	2.050
22	2.5	21.45	0	2.5	1.194	1.832	1.863	1.894	1.922	1.950	1.977	2.003	2.027	2.051
22	5	20.90	0	5	1.208	1.835	1.866	1.896	1.925	1.952	1.979	2.004	2.029	2.053
22	7.5	20.35	0	7.5	1.223	1.838	1.869	1.899	1.927	1.955	1.981	2.006	2.031	2.054
22	10	19.80	0	10	1.238	1.842	1.872	1.902	1.930	1.957	1.983	2.008	2.033	2.056
22	12.5	19.25	0	12.5	1.253	1.845	1.876	1.905	1.933	1.960	1.986	2.011	2.035	2.058
22	15	18.70	0	15	1.269	1.849	1.879	1.908	1.936	1.962	1.988	2.013	2.037	2.059
24	0	24.00	0	0	1.199	1.837	1.868	1.898	1.927	1.955	1.982	2.008	2.033	2.057
24	2.5	23.40	0	2.5	1.213	1.839	1.871	1.901	1.930	1.957	1.984	2.010	2.034	2.058
24	5	22.80	0	5	1.228	1.843	1.874	1.903	1.932	1.960	1.986	2.011	2.036	2.060
24	7.5	22.20	0	7.5	1.242	1.846	1.877	1.906	1.935	1.962	1.988	2.013	2.038	2.061
24	10	21.60	0	10	1.257	1.849	1.880	1.909	1.937	1.964	1.990	2.015	2.040	2.063
24	12.5	21.00	0	12.5	1.273	1.852	1.883	1.912	1.940	1.967	1.993	2.018	2.041	2.064
24	15	20.40	0	15	1.289	1.856	1.886	1.915	1.943	1.969	1.995	2.020	2.043	2.066
26	0	26.00	0	0	1.220	1.844	1.876	1.906	1.935	1.963	1.989	2.015	2.040	2.064
26	2.5	25.35	0	2.5	1.234	1.847	1.878	1.908	1.937	1.965	1.991	2.017	2.042	2.065
26	5	24.70	0	5	1.248	1.850	1.881	1.911	1.940	1.967	1.993	2.019	2.043	2.067
26	7.5	24.05	0	7.5	1.262	1.853	1.884	1.914	1.942	1.969	1.996	2.021	2.045	2.068
26	10	23.40	0	10	1.277	1.857	1.887	1.917	1.945	1.972	1.998	2.023	2.047	2.070
26	12.5	22.75	0	12.5	1.293	1.860	1.890	1.920	1.947	1.974	2.000	2.025	2.049	2.072
26	15	22.10	0	15	1.308	1.864	1.894	1.923	1.950	1.977	2.002	2.027	2.050	2.073
28	0	28.00	0	0	1.240	1.852	1.884	1.914	1.943	1.970	1.997	2.023	2.048	2.071
28	2.5	27.30	0	2.5	1.254	1.855	1.886	1.916	1.945	1.973	1.999	2.025	2.049	2.073
28	5	26.60	0	5	1.269	1.858	1.889	1.919	1.947	1.975	2.001	2.026	2.051	2.074
28	7.5	25.90	0	7.5	1.283	1.861	1.892	1.922	1.950	1.977	2.003	2.028	2.052	2.076
28	10	25.20	0	10	1.298	1.865	1.895	1.924	1.952	1.979	2.005	2.030	2.054	2.077
28	12.5	24.50	0	12.5	1.313	1.868	1.898	1.927	1.955	1.982	2.008	2.032	2.056	2.079
28	15	23.80	0	15	1.329	1.872	1.902	1.930	1.958	1.984	2.010	2.034	2.058	2.080
30	0	30.00	0	0	1.262	1.861	1.892	1.922	1.951	1.978	2.005	2.031	2.056	2.079
30	2.5	29.25	0	2.5	1.276	1.863	1.895	1.924	1.953	1.981	2.007	2.033	2.057	2.081
30	5	28.50	0	5	1.290	1.866	1.897	1.927	1.955	1.983	2.009	2.034	2.059	2.082
30	7.5	27.75	0	7.5	1.305	1.870	1.900	1.930	1.958	1.985	2.011	2.036	2.060	2.083
30	10	27.00	0	10	1.319	1.873	1.903	1.933	1.961	1.987	2.013	2.038	2.062	2.085
30	12.5	26.25	0	12.5	1.335	1.876	1.907	1.935	1.963	1.990	2.015	2.040	2.064	2.086
30	15	25.50	0	15	1.350	1.880	1.910	1.939	1.966	1.992	2.018	2.042	2.066	2.088
32	0	32.00	0	0	1.285	1.869	1.901	1.931	1.959	1.987	2.014	2.039	2.064	2.088
32	2.5	31.20	0	2.5	1.298	1.872	1.903	1.933	1.962	1.989	2.015	2.041	2.065	2.089
32	5	30.40	0	5	1.312	1.875	1.906	1.936	1.964	1.991	2.017	2.043	2.067	2.090
32	7.5	29.60	0	7.5	1.327	1.878	1.909	1.938	1.966	1.993	2.019	2.044	2.068	2.092
32	10	28.80	0	10	1.342	1.882	1.912	1.941	1.969	1.996	2.022	2.046	2.070	2.093
32	12.5	28.00	0	12.5	1.357	1.885	1.915	1.944	1.972	1.998	2.024	2.048	2.072	2.094
32	15	27.20	0	15	1.372	1.889	1.918	1.947	1.974	2.001	2.026	2.050	2.074	2.096
34	0	34.00	0	0	1.308	1.878	1.910	1.940	1.968	1.996	2.022	2.048	2.072	2.096
34	2.5	33.15	0	2.5	1.322	1.881	1.912	1.942	1.971	1.998	2.024	2.050	2.074	2.097
34	5	32.30	0	5	1.336	1.884	1.915	1.945	1.973	2.000	2.026	2.051	2.075	2.099
34	7.5	31.45	0	7.5	1.350	1.887	1.918	1.947	1.975	2.002	2.028	2.053	2.077	2.100
34	10	30.60	0	10	1.364	1.891	1.921	1.950	1.978	2.005	2.030	2.055	2.079	2.101
34	12.5	29.75	0	12.5	1.379	1.894	1.924	1.953	1.980	2.007	2.032	2.057	2.080	2.103
34	15	28.90	0	15	1.394	1.898	1.927	1.956	1.983	2.009	2.035	2.059	2.082	2.104
36	0	36.00	0	0	1.332	1.888	1.919	1.949	1.978	2.005	2.032	2.057	2.081	2.105
36	2.5	35.10	0	2.5	1.346	1.891	1.922	1.951	1.980	2.007	2.033	2.059	2.083	2.106
36	5	34.20	0	5	1.359	1.894	1.925	1.954	1.982	2.009	2.035	2.060	2.084	2.107
36	7.5	33.30	0	7.5	1.374	1.897	1.927	1.957	1.985	2.011	2.037	2.062	2.086	2.109
36	10	32.40	0	10	1.388	1.900	1.930	1.959	1.987	2.014	2.039	2.064	2.087	2.110
36	12.5	31.50	0	12.5	1.403	1.904	1.934	1.962	1.990	2.016	2.041	2.066	2.089	2.111
36	15	30.60	0	15	1.418	1.907	1.937	1.965	1.992	2.018	2.043	2.068	2.091	2.113
38	0	38.00	0	0	1.357	1.898	1.929	1.959	1.987	2.015	2.041	2.067	2.091	2.114
38	2.5	37.05	0	2.5	1.370	1.901	1.932	1.961	1.990	2.017	2.043	2.068	2.092	2.116
38	5	36.10	0	5	1.384	1.904	1.934	1.964	1.992	2.019	2.045	2.070	2.094	2.117
38	7.5	35.15	0	7.5	1.398	1.907	1.937	1.966	1.994	2.021	2.047	2.071	2.095	2.118
38	10	34.20	0	10	1.412	1.910	1.940	1.969	1.997	2.023	2.049	2.073	2.097	2.119
38	12.5	33.25	0	12.5	1.427	1.914	1.943	1.972	1.999	2.026	2.051	2.075	2.098	2.120
38	15	32.30	0	15	1.442	1.917	1.947	1.975	2.002	2.028	2.053	2.077	2.100	2.122
40	0	40.00	0	0	1.383	1.909	1.940	1.969	1.998	2.025	2.051	2.077	2.101	2.124
40	2.5	39.00	0	2.5	1.396	1.911	1.942	1.972	2.000	2.027	2.053	2.078	2.102	2.125
40	5	38.00	0	5	1.410	1.914	1.945	1.974	2.002	2.029	2.055	2.080	2.104	2.126
40	7.5	37.00	0	7.5	1.424	1.917	1.948	1.977	2.005	2.031	2.057	2.081	2.105	2.128
40	10	36.00	0	10	1.438	1.921	1.951	1.979	2.007	2.033	2.059	2.083	2.106	2.129
40	12.5	35.00	0	12.5	1.452	1.924	1.954	1.982	2.009	2.035	2.061	2.085	2.108	2.130
40	15	34.00	0	15	1.467	1.927	1.957	1.985	2.012	2.038	2.063	2.086	2.109	2.131

LINEAR REGRESSION OF INPUT SP. GR. vS OUTPUT SP. GR.

For Pozzolan Sp. Gr. of 2.6

Regression Output:

Constant		1.390391
Std Err of Y Est		0.004826
R Squared		0.987970
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.367152	
Std Err of Coef.	0.003365	

For Pozzolan Sp. Gr. of 2.7

Regression Output:

Constant		1.425536
Std Err of Y Est		0.005126
R Squared		0.986196
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.363670	
Std Err of Coef.	0.003573	

For Pozzolan Sp. Gr. of 2.8

Regression Output:

Constant		1.459610
Std Err of Y Est		0.005422
R Squared		0.984269
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.360033	
Std Err of Coef.	0.003780	

For Pozzolan Sp. Gr. of 2.9

Regression Output:

Constant		1.492655
Std Err of Y Est		0.005716
R Squared		0.982186
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.356267	
Std Err of Coef.	0.003985	

For Pozzolan Sp. Gr. of 3.0

Regression Output:

Constant		1.524714
Std Err of Y Est		0.006006
R Squared		0.979945
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.352396	
Std Err of Coef.	0.004187	

For Pozzolan Sp. Gr. of 3.1

Regression Output:

Constant		1.5558243395908
Std Err of Y Est		0.0062913557789782
R Squared		0.97754361527386
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.348440	
Std Err of Coef.	0.004386	

For Pozzolan Sp. Gr. of 3.2

Regression Output:

Constant		1.5860249637355
Std Err of Y Est		0.0065727649118199
R Squared		0.9749796895001
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.344418	
Std Err of Coef.	0.004582	

For Pozzolan Sp. Gr. of 3.3

Regression Output:

Constant		1.6153517845892
Std Err of Y Est		0.0068496242911872
R Squared		0.97225096116413
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.340344	
Std Err of Coef.	0.004775	

For Pozzolan Sp. Gr. of 3.4

Regression Output:

Constant		1.643839
Std Err of Y Est		0.007122
R Squared		0.969355
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.336232	
Std Err of Coef.	0.004965	

POZZOLAN SPECIFIC GRAVITY	X COEFF-ICIENT m	Y INTER-CEPT c
2.6	0.3671524	1.3903912
2.7	0.3636704	1.4255362
2.8	0.3600330	1.4596100
2.9	0.3562670	1.4926555
3.0	0.3523960	1.5247138
3.1	0.3484403	1.5558243
3.2	0.3444177	1.5860250
3.3	0.3403439	1.6153518
3.4	0.3362323	1.6438393

LINEAR REGRESSION OF X COEFFICIENT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant		0.468465
Std Err of Y Est		0.000296
R Squared		0.999323
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	-0.038786	
Std Err of Coef.	0.000382	

LINEAR REGRESSION OF Y INTERCEPT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant		0.571931
Std Err of Y Est		0.003152
R Squared		0.998845
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	0.316540	
Std Err of Coef.	0.004069	

TABLE G-15

207C/CLARIFIER

OUTPUT PRODUCT SPECIFIC GRAVITIES FOR DIFFERENT TDS & TSS CONDITIONS FOR A WATER TO POZZOLAN RATIO = 0.42

WITH CLARIFIER SILT AS PERCENTAGE OF TOTAL SILT = 10%

		SPECIFIC GRAVITY OF POZZOLANS				2.600	2.70	2.80	2.90	3.00	3.10	3.20	3.30	3.40
		SPECIFIC GRAVITY OF SALT				3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251
		SPECIFIC GRAVITY OF SILT				2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23
		SPECIFIC GRAVITY OF CLAR. SILT				2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73
		W/P RATIO				0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
		D(%)				10	10	10	10	10	10	10	10	10
TDS %	TSS %	SALT %	CLAR SILT(%)	SILT SILT(%)	INPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.
0	0	0.00	0	0	1.000	1.765	1.797	1.827	1.857	1.885	1.912	1.939	1.964	1.988
0	2.5	0.00	0.25	2.25	1.014	1.768	1.799	1.830	1.859	1.887	1.915	1.941	1.966	1.990
0	5	0.00	0.5	4.5	1.029	1.771	1.802	1.833	1.862	1.890	1.917	1.943	1.968	1.992
0	7.5	0.00	0.75	6.75	1.044	1.774	1.805	1.836	1.865	1.892	1.919	1.945	1.970	1.994
0	10	0.00	1	9	1.059	1.777	1.809	1.839	1.867	1.895	1.922	1.948	1.972	1.996
0	12.5	0.00	1.25	11.25	1.075	1.781	1.812	1.842	1.870	1.898	1.925	1.950	1.975	1.999
0	15	0.00	1.5	13.5	1.092	1.785	1.815	1.845	1.874	1.901	1.927	1.953	1.977	2.001
2	0	2.00	0	0	1.014	1.770	1.801	1.832	1.861	1.890	1.917	1.943	1.969	1.993
2	2.5	1.95	0.25	2.25	1.028	1.773	1.804	1.835	1.864	1.892	1.919	1.945	1.971	1.995
2	5	1.90	0.5	4.5	1.043	1.776	1.807	1.838	1.867	1.895	1.922	1.948	1.973	1.997
2	7.5	1.85	0.75	6.75	1.058	1.779	1.810	1.840	1.869	1.897	1.924	1.950	1.975	1.999
2	10	1.80	1	9	1.073	1.782	1.814	1.844	1.872	1.900	1.927	1.952	1.977	2.001
2	12.5	1.75	1.25	11.25	1.089	1.786	1.817	1.847	1.875	1.903	1.929	1.955	1.979	2.003
2	15	1.70	1.5	13.5	1.106	1.790	1.820	1.850	1.878	1.906	1.932	1.957	1.982	2.005
4	0	4.00	0	0	1.028	1.775	1.806	1.837	1.866	1.895	1.922	1.948	1.973	1.998
4	2.5	3.90	0.25	2.25	1.043	1.778	1.809	1.840	1.869	1.897	1.924	1.950	1.975	2.000
4	5	3.80	0.5	4.5	1.057	1.781	1.812	1.843	1.872	1.900	1.927	1.953	1.978	2.002
4	7.5	3.70	0.75	6.75	1.073	1.784	1.815	1.846	1.874	1.902	1.929	1.955	1.980	2.004
4	10	3.60	1	9	1.088	1.787	1.819	1.849	1.877	1.905	1.932	1.957	1.982	2.006
4	12.5	3.50	1.25	11.25	1.104	1.791	1.822	1.852	1.880	1.908	1.934	1.960	1.984	2.008
4	15	3.40	1.5	13.5	1.120	1.795	1.826	1.855	1.883	1.911	1.937	1.962	1.987	2.010
6	0	6.00	0	0	1.043	1.780	1.812	1.842	1.872	1.900	1.927	1.953	1.978	2.003
6	2.5	5.85	0.25	2.25	1.058	1.783	1.815	1.845	1.874	1.902	1.929	1.955	1.980	2.005
6	5	5.70	0.5	4.5	1.072	1.786	1.818	1.848	1.877	1.905	1.932	1.958	1.983	2.007
6	7.5	5.55	0.75	6.75	1.087	1.789	1.821	1.851	1.880	1.907	1.934	1.960	1.985	2.009
6	10	5.40	1	9	1.103	1.793	1.824	1.854	1.883	1.910	1.937	1.962	1.987	2.011
6	12.5	5.25	1.25	11.25	1.119	1.796	1.827	1.857	1.886	1.913	1.939	1.965	1.989	2.013
6	15	5.10	1.5	13.5	1.135	1.800	1.831	1.860	1.889	1.916	1.942	1.967	1.992	2.015
8	0	8.00	0	0	1.059	1.785	1.817	1.847	1.877	1.905	1.932	1.958	1.984	2.008
8	2.5	7.80	0.25	2.25	1.073	1.788	1.820	1.850	1.879	1.907	1.935	1.961	1.986	2.010
8	5	7.60	0.5	4.5	1.088	1.792	1.823	1.853	1.882	1.910	1.937	1.963	1.988	2.012
8	7.5	7.40	0.75	6.75	1.103	1.795	1.826	1.856	1.885	1.913	1.939	1.965	1.990	2.014
8	10	7.20	1	9	1.118	1.798	1.829	1.859	1.888	1.915	1.942	1.968	1.992	2.016
8	12.5	7.00	1.25	11.25	1.134	1.802	1.833	1.862	1.891	1.918	1.945	1.970	1.994	2.018
8	15	6.80	1.5	13.5	1.151	1.806	1.836	1.866	1.894	1.921	1.947	1.973	1.997	2.020
10	0	10.00	0	0	1.074	1.791	1.823	1.853	1.882	1.910	1.938	1.964	1.989	2.013
10	2.5	9.75	0.25	2.25	1.089	1.794	1.825	1.856	1.885	1.913	1.940	1.966	1.991	2.015
10	5	9.50	0.5	4.5	1.103	1.797	1.829	1.859	1.888	1.916	1.942	1.968	1.993	2.017
10	7.5	9.25	0.75	6.75	1.119	1.800	1.832	1.862	1.890	1.918	1.945	1.971	1.995	2.019
10	10	9.00	1	9	1.134	1.804	1.835	1.865	1.893	1.921	1.947	1.973	1.997	2.021
10	12.5	8.75	1.25	11.25	1.150	1.807	1.838	1.868	1.896	1.924	1.950	1.975	2.000	2.023
10	15	8.50	1.5	13.5	1.167	1.811	1.842	1.871	1.900	1.927	1.953	1.978	2.002	2.026
12	0	12.00	0	0	1.091	1.797	1.828	1.859	1.888	1.916	1.943	1.969	1.995	2.019
12	2.5	11.70	0.25	2.25	1.105	1.800	1.831	1.862	1.891	1.919	1.946	1.972	1.997	2.021
12	5	11.40	0.5	4.5	1.120	1.803	1.834	1.864	1.893	1.921	1.948	1.974	1.999	2.023
12	7.5	11.10	0.75	6.75	1.135	1.806	1.837	1.867	1.896	1.924	1.950	1.976	2.001	2.025
12	10	10.80	1	9	1.150	1.810	1.841	1.871	1.899	1.927	1.953	1.979	2.003	2.027
12	12.5	10.50	1.25	11.25	1.166	1.813	1.844	1.874	1.902	1.929	1.956	1.981	2.005	2.029
12	15	10.20	1.5	13.5	1.183	1.817	1.848	1.877	1.905	1.932	1.959	1.984	2.008	2.031
14	0	14.00	0	0	1.107	1.803	1.834	1.865	1.894	1.922	1.949	1.975	2.000	2.025
14	2.5	13.65	0.25	2.25	1.122	1.806	1.837	1.868	1.897	1.925	1.951	1.977	2.002	2.026
14	5	13.30	0.5	4.5	1.136	1.809	1.840	1.870	1.899	1.927	1.954	1.980	2.004	2.028
14	7.5	12.95	0.75	6.75	1.152	1.812	1.844	1.873	1.902	1.930	1.956	1.982	2.007	2.030
14	10	12.60	1	9	1.167	1.816	1.847	1.877	1.905	1.933	1.959	1.984	2.009	2.032
14	12.5	12.25	1.25	11.25	1.183	1.819	1.850	1.880	1.908	1.935	1.962	1.987	2.011	2.034
14	15	11.90	1.5	13.5	1.200	1.823	1.854	1.883	1.911	1.938	1.964	1.989	2.013	2.037
16	0	16.00	0	0	1.125	1.809	1.841	1.871	1.900	1.928	1.955	1.981	2.006	2.031
16	2.5	15.60	0.25	2.25	1.139	1.812	1.844	1.874	1.903	1.931	1.958	1.983	2.008	2.032
16	5	15.20	0.5	4.5	1.154	1.815	1.847	1.877	1.905	1.933	1.960	1.986	2.010	2.034
16	7.5	14.80	0.75	6.75	1.169	1.819	1.850	1.880	1.908	1.936	1.962	1.988	2.013	2.036
16	10	14.40	1	9	1.184	1.822	1.853	1.883	1.911	1.939	1.965	1.990	2.015	2.038
16	12.5	14.00	1.25	11.25	1.200	1.826	1.857	1.886	1.914	1.942	1.968	1.993	2.017	2.040
16	15	13.60	1.5	13.5	1.217	1.830	1.860	1.889	1.918	1.944	1.970	1.995	2.019	2.043
18	0	18.00	0	0	1.142	1.815	1.847	1.877	1.906	1.935	1.961	1.987	2.013	2.037
18	2.5	17.55	0.25	2.25	1.157	1.819	1.850	1.880	1.909	1.937	1.964	1.990	2.015	2.039
18	5	17.10	0.5	4.5	1.171	1.822	1.853	1.883	1.912	1.940	1.966	1.992	2.017	2.040
18	7.5	16.65	0.75	6.75	1.187	1.825	1.856	1.886	1.915	1.942	1.969	1.994	2.019	2.042
18	10	16.20	1	9	1.202	1.829	1.860	1.889	1.918	1.945	1.971	1.997	2.021	2.044
18	12.5	15.75	1.25	11.25	1.218	1.832	1.863	1.892	1.921	1.948	1.974	1.999	2.023	2.046
18	15	15.30	1.5	13.5	1.234	1.836	1.867	1.896	1.924	1.951	1.977	2.002	2.026	2.049
20	0	20.00	0	0	1.161	1.822	1.854	1.884	1.913	1.941	1.968	1.994	2.019	2.043
20	2.5	19.50	0.25	2.25	1.175	1.825	1.857	1.887	1.916	1.944	1.970	1.996	2.021	2.045
20	5	19.00	0.5	4.5	1.190	1.829	1.860	1.890	1.919	1.946	1.973	1.998	2.023	2.047
20	7.5	18.50	0.75	6.75	1.205	1.832	1.863	1.893	1.921	1.949	1.975	2.001	2.025	2.049
20	10	18.00	1	9	1.220	1.836	1.866	1.896	1.924	1.952	1.978	2.003	2.027	2.051
20	12.5	17.50	1.25	11.25	1.236	1.839	1.870	1.899	1.927	1.954	1.980	2.005	2.030	2.053
20	15	17.00	1.5	13.5	1.253	1.843	1.873	1.903	1.931	1.957	1.983	2.008	2.032	2.055
22	0	22.00	0	0	1.180	1.829	1.861	1.891	1.920	1.948	1.975	2.001	2.026	2.050
22	2.5	21.45	0.25	2.25	1.194	1.832	1.864	1.894	1.923	1.950	1.977	2.003	2.028	2.052
22	5	20.90	0.5	4.5	1.209	1.836	1.867	1.897	1.925	1.953	1.980	2.005	2.030	2.053
22	7.5	20.35	0.75	6.75	1.224	1.839	1.870	1.900	1.928	1.956	1.982	2.007	2.032	2.055
22	10	19.80	1	9	1.239	1.843	1.873	1.903	1.931	1.958	1.985	2.010	2.034	2.057
22	12.5	19.25	1.25	11.25	1.255	1.846	1.877	1.906	1.934	1.961	1.987	2.012	2.036	2.059
22	15	18.70	1.5	13.5	1.271	1.850	1.881	1.910	1.937	1.964	1.990	2.015	2.039	2.061
24	0	24.00	0	0	1.199	1.837	1.868	1.898	1.927	1.955	1.982	2.008	2.033	2.057
24	2.5	23.40	0.25	2.25	1.214	1.840	1.871	1.901	1.930	1.958	1.984	2.010	2.035	2.058
24	5	22.80	0.5	4.5	1.228	1.843	1.874	1.904	1.933	1.960	1.987	2.012	2.037	2.060
24	7.5	22.20	0.75	6.75	1.243	1.846	1.877	1.907	1.935	1.963	1.989	2.014	2.039	2.062
24	10	21.60	1	9	1.259	1.850	1.881	1.910	1.938	1.966	1.992	2.017	2.041	2.064
24	12.5	21.00	1.25	11.25	1.274	1.854	1.884	1.913	1.941	1.968	1.994	2.019	2.043	2.066
24	15	20.40	1.5	13.5	1.291	1.858	1.888	1.917	1.945	1.971	1.997	2.022	2.045	2.068
26	0	26.00	0	0	1.220	1.844	1.876	1.906	1.935	1.963	1.989	2.015	2.040	2.064
26	2.5	25.35	0.25	2.25	1.234	1.847	1.879	1.909	1.937	1.965	1.992	2.017	2.042	2.066
26	5	24.70	0.5	4.5	1.248	1.851	1.882	1.912	1.940	1.968	1.994	2.019	2.044	2.067
26	7.5	24.05	0.75	6.75	1.263	1.854	1.885	1.915	1.943	1.970	1.996	2.022	2.046	2.069
26	10	23.40	1	9	1.279	1.858	1.888	1.918	1.946	1.973	1.999	2.024	2.048	2.071
26	12.5	22.75	1.25	11.25	1.294	1.861	1.892	1.921	1.949	1.976	2.002	2.026	2.050	2.073
26	15	22.10	1.5	13.5	1.311	1.865	1.895	1.924	1.952	1.979	2.004	2.029	2.053	2.075
28	0	28.00	0	0	1.240	1.852	1.884	1.914	1.943	1.970	1.997	2.023	2.048	2.071
28	2.5	27.30	0.25	2.25	1.255	1.855	1.887	1.916	1.945	1.973	1.999	2.025	2.049	2.073
28	5	26.60	0.5	4.5	1.269	1.859	1.890	1.919	1.948	1.975	2.002	2.027	2.051	2.075
28	7.5	25.90	0.75	6.75	1.284	1.862	1.893	1.922	1.951	1.978	2.004	2.029	2.053	2.077
28	10	25.20	1	9	1.299	1.866	1.896	1.926	1.954	1.981	2.007	2.032	2.056	2.079
28	12.5	24.50	1.25	11.25	1.315	1.869	1.900	1.929	1.957	1.984	2.009	2.034	2.058	2.081
28	15	23.80	1.5	13.5	1.331	1.873	1.903	1.932	1.960	1.986	2.012	2.036	2.060	2.083
30	0	30.00	0	0	1.262	1.861	1.892	1.922	1.951	1.978	2.005	2.031	2.056	2.079
30	2.5	29.25	0.25	2.25	1.276	1.864	1.895	1.925	1.953	1.981	2.007	2.033	2.057	2.081
30	5	28.50	0.5	4.5	1.291	1.867	1.898	1.928	1.956	1.983	2.010	2.035	2.059	2.083
30	7.5	27.75	0.75	6.75	1.306	1.870	1.901	1.931	1.959	1.986	2.012	2.037	2.061	2.085
30	10	27.00	1	9	1.321	1.874	1.905	1.934	1.962	1.989	2.015	2.039	2.063	2.086
30	12.5	26.25	1.25	11.25	1.336	1.878	1.908	1.937	1.965	1.992	2.017	2.042	2.065	2.088
30	15	25.50	1.5	13.5	1.352	1.882	1.912	1.940	1.968	1.994	2.020	2.044	2.068	2.090
32	0	32.00	0	0	1.285	1.869	1.901	1.931	1.959	1.987	2.014	2.039	2.064	2.088
32	2.5	31.20	0.25	2.25	1.299	1.872	1.904	1.933	1.962	1.989	2.016	2.041	2.066	2.089
32	5	30.40	0.5	4.5	1.313	1.876	1.907	1.936	1.965	1.992	2.018	2.043	2.068	2.091
32	7.5	29.60	0.75	6.75	1.328	1.879	1.910	1.939	1.967	1.994	2.020	2.045	2.069	2.093
32	10	28.80	1	9	1.343	1.883	1.913	1.942	1.970	1.997	2.023	2.048	2.071	2.094
32	12.5	28.00	1.25	11.25	1.358	1.887	1.917	1.946	1.973	2.000	2.025	2.050	2.074	2.096
32	15	27.20	1.5	13.5	1.374	1.890	1.920	1.949	1.976	2.003	2.028	2.052	2.076	2.098
34	0	34.00	0	0	1.308	1.878	1.910	1.940	1.968	1.996	2.022	2.048	2.072	2.096
34	2.5	33.15	0.25	2.25	1.322	1.882	1.913	1.942	1.971	1.998	2.025	2.050	2.074	2.098
34	5	32.30	0.5	4.5	1.336	1.885	1.916	1.945	1.974	2.001	2.027	2.052	2.076	2.099
34	7.5	31.45	0.75	6.75	1.351	1.888	1.919	1.948	1.976	2.003	2.029	2.054	2.078	2.101
34	10	30.60	1	9	1.366	1.892	1.922	1.951	1.979	2.006	2.032	2.056	2.080	2.103
34	12.5	29.75	1.25	11.25	1.381	1.896	1.926	1.955	1.982	2.009	2.034	2.059	2.082	2.105
34	15	28.90	1.5	13.5	1.397	1.899	1.929	1.958	1.985	2.012	2.037	2.061	2.084	2.107
36	0	36.00	0	0	1.332	1.888	1.919	1.949	1.978	2.005	2.032	2.057	2.081	2.105
36	2.5	35.10	0.25	2.25	1.346	1.891	1.922	1.952	1.980	2.008	2.034	2.059	2.083	2.107
36	5	34.20	0.5	4.5	1.360	1.894	1.925	1.955	1.983	2.010	2.036	2.061	2.085	2.108
36	7.5	33.30	0.75	6.75	1.375	1.898	1.928	1.958	1.986	2.012	2.038	2.063	2.087	2.110
36	10	32.40	1	9	1.389	1.901	1.932	1.961	1.988	2.015	2.041	2.065	2.089	2.112
36	12.5	31.50	1.25	11.25	1.405	1.905	1.935	1.964	1.991	2.018	2.043	2.067	2.091	2.113
36	15	30.60	1.5	13.5	1.420	1.909	1.939	1.967	1.994	2.021	2.046	2.070	2.093	2.115
38	0	38.00	0	0	1.357	1.898	1.929	1.959	1.987	2.015	2.041	2.067	2.091	2.114
38	2.5	37.05	0.25	2.25	1.371	1.901	1.932	1.962	1.990	2.017	2.043	2.069	2.093	2.116
38	5	36.10	0.5	4.5	1.385	1.904	1.935	1.964	1.993	2.020	2.046	2.070	2.094	2.118
38	7.5	35.15	0.75	6.75	1.399	1.908	1.938	1.967	1.995	2.022	2.048	2.073	2.096	2.119
38	10	34.20	1	9	1.414	1.911	1.942	1.971	1.998	2.025	2.050	2.075	2.098	2.121
38	12.5	33.25	1.25	11.25	1.429	1.915	1.945	1.974	2.001	2.027	2.053	2.077	2.100	2.122
38	15	32.30	1.5	13.5	1.444	1.919	1.949	1.977	2.004	2.030	2.055	2.079	2.102	2.124
40	0	40.00	0	0	1.383	1.909	1.940	1.969	1.998	2.025	2.051	2.077	2.101	2.124
40	2.5	39.00	0.25	2.25	1.397	1.912	1.943	1.972	2.000	2.027	2.053	2.079	2.103	2.126
40	5	38.00	0.5	4.5	1.411	1.915	1.946	1.975	2.003	2.030	2.056	2.080	2.104	2.127
40	7.5	37.00	0.75	6.75	1.425	1.918	1.949	1.978	2.006	2.032	2.058	2.082	2.106	2.129
40	10	36.00	1	9	1.439	1.922	1.952	1.981	2.008	2.035	2.060	2.084	2.108	2.130
40	12.5	35.00	1.25	11.25	1.454	1.926	1.955	1.984	2.011	2.037	2.062	2.087	2.110	2.132
40	15	34.00	1.5	13.5	1.469	1.929	1.959	1.987	2.014	2.040	2.065	2.089	2.112	2.134

LINEAR REGRESSION OF INPUT SP. GR. vS OUTPUT SP. GR.

For Pozzolan Sp. Gr. of 2.6

Regression Output:

Constant	1.389799
Std Err of Y Est	0.004557
R Squared	0.989371
No. of Observations	147
Degrees of Freedom	145
X Coefficient(s)	0.367999
Std Err of Coef.	0.003168

For Pozzolan Sp. Gr. of 2.7

Regression Output:

Constant	1.424903
Std Err of Y Est	0.004836
R Squared	0.987823
No. of Observations	147
Degrees of Freedom	145
X Coefficient(s)	0.364575
Std Err of Coef.	0.003362

For Pozzolan Sp. Gr. of 2.8

Regression Output:

Constant	1.458937
Std Err of Y Est	0.005113
R Squared	0.986140
No. of Observations	147
Degrees of Freedom	145
X Coefficient(s)	0.360994
Std Err of Coef.	0.003554

For Pozzolan Sp. Gr. of 2.9

Regression Output:

Constant	1.491945
Std Err of Y Est	0.005387
R Squared	0.984321
No. of Observations	147
Degrees of Freedom	145
X Coefficient(s)	0.357283
Std Err of Coef.	0.003745

For Pozzolan Sp. Gr. of 3.0

Regression Output:

Constant	1.523965
Std Err of Y Est	0.005658
R Squared	0.982363
No. of Observations	147
Degrees of Freedom	145
X Coefficient(s)	0.353465
Std Err of Coef.	0.003933

For Pozzolan Sp. Gr. of 3.1

Regression Output:

Constant	1.555039565671
Std Err of Y Est	0.00592556151133802
R Squared	0.98026385642686
No. of Observations	147
Degrees of Freedom	145
X Coefficient(s)	0.349562
Std Err of Coef.	0.004119

For Pozzolan Sp. Gr. of 3.2

Regression Output:

Constant	1.5852047205078
Std Err of Y Est	0.0061891322137312
R Squared	0.97802177208096
No. of Observations	147
Degrees of Freedom	145
X Coefficient(s)	0.345591
Std Err of Coef.	0.004302

For Pozzolan Sp. Gr. of 3.3

Regression Output:

Constant	1.6144970057228
Std Err of Y Est	0.0064485803315522
R Squared	0.97563464967094
No. of Observations	147
Degrees of Freedom	145
X Coefficient(s)	0.341567
Std Err of Coef.	0.004483

For Pozzolan Sp. Gr. of 3.4

Regression Output:

Constant	1.642951
Std Err of Y Est	0.006704
R Squared	0.973101
No. of Observations	147
Degrees of Freedom	145
X Coefficient(s)	0.337504
Std Err of Coef.	0.004660

POZZOLAN SPECIFIC GRAVITY	X COEFF-ICIENT m	Y INTER-CEPT c
2.6	0.3679993	1.3897985
2.7	0.3645748	1.4249031
2.8	0.3609936	1.4589375
2.9	0.3572827	1.4919445
3.0	0.3534653	1.5239654
3.1	0.3495621	1.5550396
3.2	0.3455908	1.5852047
3.3	0.3415670	1.6144970
3.4	0.3375042	1.6429509

LINEAR REGRESSION OF X COEFFICIENT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant	0.467936
Std Err of Y Est	0.000300
R Squared	0.999284
No. of Observations	9
Degrees of Freedom	7
X Coefficient(s)	-0.038255
Std Err of Coef.	0.000387

LINEAR REGRESSION OF Y INTERCEPT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant	0.572294
Std Err of Y Est	0.003148
R Squared	0.998844
No. of Observations	9
Degrees of Freedom	7
X Coefficient(s)	0.316170
Std Err of Coef.	0.004065

TABLE G 10

207C/CLARIFIER

OUT[illegible]DUCT SPECIFIC GRAVITIES FOR DIFFERENT TDS & TSS CONDITIONS FOR A WATER TO POZZOLAN RATI[illegible]2

WITH CLARIFIER SILT AS PERCENTAGE OF TOTAL SILT = 20%

SPECIFIC GRAVITY OF POZZOLANS	2.600	2.70	2.80	2.90	3.00	3.10	3.20	3.30	3.40
SPECIFIC GRAVITY OF SALT	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251
SPECIFIC GRAVITY OF SILT	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23
SPECIFIC GRAVITY OF CLAR. SILT	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73
W/P RATIO	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
D(%)	20	20	20	20	20	20	20	20	20

TDS %	TSS %	SALT %	CLAR SILT(%)	SUPE SILT(%)	INPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.
0	0	0.00	0	0	1.000	1.765	1.797	1.827	1.857	1.885	1.912	1.939	1.964	1.988
0	2.5	0.00	0.5	2	1.014	1.768	1.800	1.830	1.859	1.888	1.915	1.941	1.966	1.991
0	5	0.00	1	4	1.029	1.771	1.803	1.833	1.862	1.890	1.917	1.943	1.969	1.993
0	7.5	0.00	1.5	6	1.044	1.775	1.806	1.836	1.865	1.893	1.920	1.946	1.971	1.995
0	10	0.00	2	8	1.060	1.778	1.810	1.840	1.868	1.896	1.923	1.949	1.973	1.997
0	12.5	0.00	2.5	10	1.076	1.782	1.813	1.843	1.872	1.899	1.926	1.951	1.976	2.000
0	15	0.00	3	12	1.093	1.786	1.817	1.846	1.875	1.902	1.929	1.954	1.979	2.002
2	0	2.00	0	0	1.014	1.770	1.801	1.832	1.861	1.890	1.917	1.943	1.969	1.993
2	2.5	1.95	0.5	2	1.028	1.773	1.805	1.835	1.864	1.892	1.920	1.946	1.971	1.995
2	5	1.90	1	4	1.043	1.776	1.808	1.838	1.867	1.895	1.922	1.948	1.973	1.997
2	7.5	1.85	1.5	6	1.059	1.780	1.811	1.841	1.870	1.898	1.925	1.951	1.976	2.000
2	10	1.80	2	8	1.074	1.783	1.814	1.844	1.873	1.901	1.928	1.953	1.978	2.002
2	12.5	1.75	2.5	10	1.091	1.787	1.818	1.848	1.877	1.904	1.931	1.956	1.981	2.005
2	15	1.70	3	12	1.107	1.791	1.822	1.851	1.880	1.907	1.934	1.959	1.984	2.007
4	0	4.00	0	0	1.028	1.775	1.806	1.837	1.866	1.895	1.922	1.948	1.973	1.998
4	2.5	3.90	0.5	2	1.043	1.778	1.810	1.840	1.869	1.897	1.924	1.951	1.976	2.000
4	5	3.80	1	4	1.058	1.781	1.813	1.843	1.872	1.900	1.927	1.953	1.978	2.002
4	7.5	3.70	1.5	6	1.073	1.785	1.816	1.846	1.875	1.903	1.930	1.956	1.981	2.005
4	10	3.60	2	8	1.089	1.788	1.820	1.849	1.878	1.906	1.933	1.958	1.983	2.007
4	12.5	3.50	2.5	10	1.105	1.792	1.823	1.853	1.882	1.909	1.936	1.961	1.986	2.009
4	15	3.40	3	12	1.122	1.796	1.827	1.857	1.885	1.912	1.939	1.964	1.988	2.012
6	0	6.00	0	0	1.043	1.780	1.812	1.842	1.872	1.900	1.927	1.953	1.978	2.003
6	2.5	5.85	0.5	2	1.058	1.783	1.815	1.845	1.874	1.902	1.929	1.956	1.981	2.005
6	5	5.70	1	4	1.073	1.786	1.818	1.848	1.877	1.905	1.932	1.958	1.983	2.007
6	7.5	5.55	1.5	6	1.088	1.790	1.821	1.851	1.880	1.908	1.935	1.961	1.986	2.009
6	10	5.40	2	8	1.104	1.794	1.825	1.855	1.883	1.911	1.938	1.963	1.988	2.012
6	12.5	5.25	2.5	10	1.120	1.797	1.828	1.858	1.887	1.914	1.941	1.966	1.991	2.014
6	15	5.10	3	12	1.137	1.801	1.832	1.862	1.890	1.918	1.944	1.969	1.993	2.017
8	0	8.00	0	0	1.059	1.785	1.817	1.847	1.877	1.905	1.932	1.958	1.984	2.008
8	2.5	7.80	0.5	2	1.073	1.789	1.820	1.850	1.880	1.908	1.935	1.961	1.986	2.010
8	5	7.60	1	4	1.088	1.792	1.823	1.854	1.883	1.911	1.937	1.963	1.988	2.012
8	7.5	7.40	1.5	6	1.104	1.795	1.827	1.857	1.886	1.913	1.940	1.966	1.991	2.015
8	10	7.20	2	8	1.119	1.799	1.830	1.860	1.889	1.916	1.943	1.969	1.993	2.017
8	12.5	7.00	2.5	10	1.136	1.803	1.834	1.864	1.892	1.920	1.946	1.971	1.996	2.019
8	15	6.80	3	12	1.152	1.807	1.838	1.867	1.896	1.923	1.949	1.974	1.999	2.022
10	0	10.00	0	0	1.074	1.791	1.823	1.853	1.882	1.910	1.938	1.964	1.989	2.013
10	2.5	9.75	0.5	2	1.089	1.794	1.826	1.856	1.885	1.913	1.940	1.966	1.991	2.015
10	5	9.50	1	4	1.104	1.798	1.829	1.859	1.888	1.916	1.943	1.969	1.994	2.018
10	7.5	9.25	1.5	6	1.119	1.801	1.832	1.862	1.891	1.919	1.946	1.971	1.996	2.020
10	10	9.00	2	8	1.135	1.805	1.836	1.866	1.894	1.922	1.948	1.974	1.999	2.022
10	12.5	8.75	2.5	10	1.152	1.809	1.840	1.869	1.898	1.925	1.951	1.977	2.001	2.025
10	15	8.50	3	12	1.168	1.813	1.843	1.873	1.901	1.928	1.955	1.980	2.004	2.027
12	0	12.00	0	0	1.091	1.797	1.828	1.859	1.888	1.916	1.943	1.969	1.995	2.019
12	2.5	11.70	0.5	2	1.105	1.800	1.831	1.862	1.891	1.919	1.946	1.972	1.997	2.021
12	5	11.40	1	4	1.120	1.803	1.835	1.865	1.894	1.922	1.949	1.974	1.999	2.023
12	7.5	11.10	1.5	6	1.136	1.807	1.838	1.868	1.897	1.925	1.951	1.977	2.002	2.025
12	10	10.80	2	8	1.152	1.811	1.842	1.872	1.900	1.928	1.954	1.980	2.004	2.028
12	12.5	10.50	2.5	10	1.168	1.815	1.845	1.875	1.904	1.931	1.957	1.982	2.007	2.030
12	15	10.20	3	12	1.185	1.819	1.849	1.879	1.907	1.934	1.960	1.985	2.010	2.033
14	0	14.00	0	0	1.107	1.803	1.834	1.865	1.894	1.922	1.949	1.975	2.000	2.025
14	2.5	13.65	0.5	2	1.122	1.806	1.838	1.868	1.897	1.925	1.952	1.978	2.003	2.027
14	5	13.30	1	4	1.137	1.809	1.841	1.871	1.900	1.928	1.954	1.980	2.005	2.029
14	7.5	12.95	1.5	6	1.152	1.813	1.844	1.874	1.903	1.931	1.957	1.983	2.007	2.031
14	10	12.60	2	8	1.168	1.817	1.848	1.878	1.906	1.934	1.960	1.985	2.010	2.034
14	12.5	12.25	2.5	10	1.185	1.821	1.852	1.881	1.909	1.937	1.963	1.988	2.013	2.036
14	15	11.90	3	12	1.201	1.825	1.855	1.885	1.913	1.940	1.966	1.991	2.015	2.039
16	0	16.00	0	0	1.125	1.809	1.841	1.871	1.900	1.928	1.955	1.981	2.006	2.031
16	2.5	15.60	0.5	2	1.139	1.812	1.844	1.874	1.903	1.931	1.958	1.984	2.009	2.033
16	5	15.20	1	4	1.154	1.816	1.847	1.877	1.906	1.934	1.960	1.986	2.011	2.035
16	7.5	14.80	1.5	6	1.170	1.819	1.851	1.880	1.909	1.937	1.963	1.989	2.013	2.037
16	10	14.40	2	8	1.186	1.823	1.854	1.884	1.912	1.940	1.966	1.991	2.016	2.039
16	12.5	14.00	2.5	10	1.202	1.827	1.858	1.887	1.916	1.943	1.969	1.994	2.019	2.042
16	15	13.60	3	12	1.219	1.831	1.862	1.891	1.919	1.946	1.972	1.997	2.021	2.044
18	0	18.00	0	0	1.142	1.815	1.847	1.877	1.906	1.935	1.961	1.987	2.013	2.037
18	2.5	17.55	0.5	2	1.157	1.819	1.850	1.880	1.909	1.937	1.964	1.990	2.015	2.039
18	5	17.10	1	4	1.172	1.822	1.854	1.884	1.912	1.940	1.967	1.992	2.017	2.041
18	7.5	16.65	1.5	6	1.187	1.826	1.857	1.887	1.916	1.943	1.970	1.995	2.020	2.043
18	10	16.20	2	8	1.203	1.830	1.861	1.890	1.919	1.946	1.972	1.998	2.022	2.046
18	12.5	15.75	2.5	10	1.220	1.834	1.864	1.894	1.922	1.949	1.975	2.001	2.025	2.048
18	15	15.30	3	12	1.236	1.838	1.868	1.898	1.926	1.953	1.979	2.003	2.027	2.051
20	0	20.00	0	0	1.161	1.822	1.854	1.884	1.913	1.941	1.968	1.994	2.019	2.043
20	2.5	19.50	0.5	2	1.175	1.826	1.857	1.887	1.916	1.944	1.971	1.996	2.021	2.045
20	5	19.00	1	4	1.190	1.829	1.860	1.890	1.919	1.947	1.973	1.999	2.024	2.047
20	7.5	18.50	1.5	6	1.206	1.833	1.864	1.894	1.922	1.950	1.976	2.002	2.026	2.050
20	10	18.00	2	8	1.222	1.837	1.867	1.897	1.925	1.953	1.979	2.004	2.029	2.052
20	12.5	17.50	2.5	10	1.238	1.841	1.871	1.901	1.929	1.956	1.982	2.007	2.031	2.054
20	15	17.00	3	12	1.255	1.845	1.875	1.904	1.932	1.959	1.985	2.010	2.034	2.057
22	0	22.00	0	0	1.180	1.829	1.861	1.891	1.920	1.948	1.975	2.001	2.026	2.050
22	2.5	21.45	0.5	2	1.194	1.833	1.864	1.894	1.923	1.951	1.977	2.003	2.028	2.052
22	5	20.90	1	4	1.209	1.836	1.867	1.897	1.926	1.954	1.980	2.006	2.030	2.054
22	7.5	20.35	1.5	6	1.225	1.840	1.871	1.901	1.929	1.957	1.983	2.008	2.033	2.056
22	10	19.80	2	8	1.241	1.844	1.874	1.904	1.932	1.960	1.986	2.011	2.035	2.059
22	12.5	19.25	2.5	10	1.257	1.848	1.878	1.908	1.936	1.963	1.989	2.014	2.038	2.061
22	15	18.70	3	12	1.273	1.852	1.882	1.911	1.939	1.966	1.992	2.017	2.041	2.064
24	0	24.00	0	0	1.199	1.837	1.868	1.898	1.927	1.955	1.982	2.008	2.033	2.057
24	2.5	23.40	0.5	2	1.214	1.840	1.871	1.901	1.930	1.958	1.985	2.010	2.035	2.059
24	5	22.80	1	4	1.229	1.844	1.875	1.905	1.933	1.961	1.987	2.013	2.037	2.061
24	7.5	22.20	1.5	6	1.244	1.847	1.878	1.908	1.936	1.964	1.990	2.015	2.040	2.063
24	10	21.60	2	8	1.260	1.851	1.882	1.911	1.940	1.967	1.993	2.018	2.042	2.065
24	12.5	21.00	2.5	10	1.276	1.855	1.886	1.915	1.943	1.970	1.996	2.021	2.045	2.068
24	15	20.40	3	12	1.293	1.859	1.890	1.919	1.946	1.973	1.999	2.024	2.047	2.070
26	0	26.00	0	0	1.220	1.844	1.876	1.906	1.935	1.963	1.989	2.015	2.040	2.064
26	2.5	25.35	0.5	2	1.234	1.848	1.879	1.909	1.938	1.965	1.992	2.018	2.042	2.066
26	5	24.70	1	4	1.249	1.851	1.882	1.912	1.941	1.968	1.995	2.020	2.045	2.068
26	7.5	24.05	1.5	6	1.264	1.855	1.886	1.915	1.944	1.971	1.997	2.023	2.047	2.070
26	10	23.40	2	8	1.280	1.859	1.889	1.919	1.947	1.974	2.000	2.025	2.049	2.073
26	12.5	22.75	2.5	10	1.296	1.863	1.893	1.922	1.950	1.977	2.003	2.028	2.052	2.075
26	15	22.10	3	12	1.313	1.867	1.897	1.926	1.954	1.981	2.006	2.031	2.055	2.077
28	0	28.00	0	0	1.240	1.852	1.884	1.914	1.943	1.970	1.997	2.023	2.048	2.071
28	2.5	27.30	0.5	2	1.255	1.856	1.887	1.917	1.946	1.973	2.000	2.025	2.050	2.073
28	5	26.60	1	4	1.270	1.859	1.890	1.920	1.949	1.976	2.002	2.028	2.052	2.076
28	7.5	25.90	1.5	6	1.285	1.863	1.894	1.923	1.952	1.979	2.005	2.030	2.054	2.078
28	10	25.20	2	8	1.301	1.867	1.897	1.927	1.955	1.982	2.008	2.033	2.057	2.080
28	12.5	24.50	2.5	10	1.317	1.871	1.901	1.930	1.958	1.985	2.011	2.036	2.059	2.082
28	15	23.80	3	12	1.333	1.875	1.905	1.934	1.962	1.988	2.014	2.039	2.062	2.085
30	0	30.00	0	0	1.262	1.861	1.892	1.922	1.951	1.978	2.005	2.031	2.056	2.079
30	2.5	29.25	0.5	2	1.277	1.864	1.895	1.925	1.954	1.981	2.008	2.033	2.058	2.081
30	5	28.50	1	4	1.292	1.868	1.899	1.928	1.957	1.984	2.010	2.036	2.060	2.083
30	7.5	27.75	1.5	6	1.307	1.871	1.902	1.932	1.960	1.987	2.013	2.038	2.062	2.086
30	10	27.00	2	8	1.322	1.875	1.906	1.935	1.963	1.990	2.016	2.041	2.065	2.088
30	12.5	26.25	2.5	10	1.338	1.879	1.910	1.939	1.966	1.993	2.019	2.044	2.067	2.090
30	15	25.50	3	12	1.355	1.883	1.914	1.942	1.970	1.996	2.022	2.046	2.070	2.093
32	0	32.00	0	0	1.285	1.869	1.901	1.931	1.959	1.987	2.014	2.039	2.064	2.088
32	2.5	31.20	0.5	2	1.299	1.873	1.904	1.934	1.962	1.990	2.016	2.042	2.066	2.090
32	5	30.40	1	4	1.314	1.876	1.907	1.937	1.965	1.993	2.019	2.044	2.068	2.092
32	7.5	29.60	1.5	6	1.329	1.880	1.911	1.940	1.968	1.995	2.021	2.046	2.071	2.094
32	10	28.80	2	8	1.344	1.884	1.914	1.944	1.972	1.998	2.024	2.049	2.073	2.096
32	12.5	28.00	2.5	10	1.360	1.888	1.918	1.947	1.975	2.002	2.027	2.052	2.075	2.098
32	15	27.20	3	12	1.377	1.892	1.922	1.951	1.978	2.005	2.030	2.055	2.078	2.101
34	0	34.00	0	0	1.308	1.878	1.910	1.940	1.968	1.996	2.022	2.048	2.072	2.096
34	2.5	33.15	0.5	2	1.322	1.882	1.913	1.943	1.971	1.999	2.025	2.050	2.075	2.098
34	5	32.30	1	4	1.337	1.885	1.916	1.946	1.974	2.001	2.028	2.053	2.077	2.100
34	7.5	31.45	1.5	6	1.352	1.889	1.920	1.949	1.977	2.004	2.030	2.055	2.079	2.102
34	10	30.60	2	8	1.367	1.893	1.924	1.953	1.981	2.007	2.033	2.058	2.081	2.104
34	12.5	29.75	2.5	10	1.383	1.897	1.927	1.956	1.984	2.010	2.036	2.060	2.084	2.107
34	15	28.90	3	12	1.399	1.901	1.931	1.960	1.987	2.014	2.039	2.063	2.086	2.109
36	0	36.00	0	0	1.332	1.888	1.919	1.949	1.978	2.005	2.032	2.057	2.081	2.105
36	2.5	35.10	0.5	2	1.346	1.891	1.922	1.952	1.981	2.008	2.034	2.059	2.084	2.107
36	5	34.20	1	4	1.361	1.895	1.926	1.955	1.984	2.011	2.037	2.062	2.086	2.109
36	7.5	33.30	1.5	6	1.376	1.899	1.929	1.959	1.987	2.014	2.039	2.064	2.088	2.111
36	10	32.40	2	8	1.391	1.903	1.933	1.962	1.990	2.017	2.042	2.067	2.090	2.113
36	12.5	31.50	2.5	10	1.407	1.907	1.937	1.966	1.993	2.020	2.045	2.069	2.093	2.115
36	15	30.60	3	12	1.423	1.911	1.941	1.969	1.997	2.023	2.048	2.072	2.095	2.118
38	0	38.00	0	0	1.357	1.898	1.929	1.959	1.987	2.015	2.041	2.067	2.091	2.114
38	2.5	37.05	0.5	2	1.371	1.901	1.932	1.962	1.990	2.018	2.044	2.069	2.093	2.116
38	5	36.10	1	4	1.386	1.905	1.936	1.965	1.993	2.020	2.046	2.071	2.095	2.118
38	7.5	35.15	1.5	6	1.401	1.909	1.939	1.968	1.996	2.023	2.049	2.074	2.097	2.120
38	10	34.20	2	8	1.416	1.913	1.943	1.972	2.000	2.026	2.052	2.076	2.100	2.122
38	12.5	33.25	2.5	10	1.431	1.917	1.947	1.975	2.003	2.029	2.054	2.079	2.102	2.125
38	15	32.30	3	12	1.447	1.921	1.951	1.979	2.006	2.032	2.057	2.081	2.105	2.127
40	0	40.00	0	0	1.383	1.909	1.940	1.969	1.998	2.025	2.051	2.077	2.101	2.124
40	2.5	39.00	0.5	2	1.397	1.912	1.943	1.972	2.001	2.028	2.054	2.079	2.103	2.126
40	5	38.00	1	4	1.411	1.916	1.946	1.976	2.004	2.030	2.056	2.081	2.105	2.128
40	7.5	37.00	1.5	6	1.426	1.919	1.950	1.979	2.007	2.033	2.059	2.084	2.107	2.130
40	10	36.00	2	8	1.441	1.923	1.953	1.982	2.010	2.036	2.062	2.086	2.109	2.132
40	12.5	35.00	2.5	10	1.456	1.927	1.957	1.986	2.013	2.039	2.064	2.089	2.112	2.134
40	15	34.00	3	12	1.472	1.931	1.961	1.989	2.016	2.042	2.067	2.091	2.114	2.136

LINEAR REGRESSION OF INPUT SP. GR. vS OUTPUT SP. GR.

For Pozzolan Sp. Gr. of 2.6

Regression Output:

Constant		1.389180
Std Err of Y Est		0.004290
R Squared		0.990666
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.368866	
Std Err of Coef.	0.002973	

For Pozzolan Sp. Gr. of 2.7

Regression Output:

Constant		1.424242
Std Err of Y Est		0.004548
R Squared		0.989327
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.365501	
Std Err of Coef.	0.003153	

For Pozzolan Sp. Gr. of 2.8

Regression Output:

Constant		1.458235
Std Err of Y Est		0.004805
R Squared		0.987871
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.361978	
Std Err of Coef.	0.003331	

For Pozzolan Sp. Gr. of 2.9

Regression Output:

Constant		1.491202
Std Err of Y Est		0.005060
R Squared		0.986296
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.358323	
Std Err of Coef.	0.003508	

For Pozzolan Sp. Gr. of 3.0

Regression Output:

Constant		1.523183
Std Err of Y Est		0.005313
R Squared		0.984600
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.354561	
Std Err of Coef.	0.003682	

For Pozzolan Sp. Gr. of 3.1

Regression Output:

Constant		1.5542192996357
Std Err of Y Est		0.0055618001628488
R Squared		0.98278094681331
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.350712	
Std Err of Coef.	0.003855	

For Pozzolan Sp. Gr. of 3.2

Regression Output:

Constant		1.5843472281527
Std Err of Y Est		0.0058074681174512
R Squared		0.98083749728227
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.346793	
Std Err of Coef.	0.004025	

For Pozzolan Sp. Gr. of 3.3

Regression Output:

Constant		1.6136032541855
Std Err of Y Est		0.0060494485973291
R Squared		0.97876758112142
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.342821	
Std Err of Coef.	0.004193	

For Pozzolan Sp. Gr. of 3.4

Regression Output:

Constant		1.642022
Std Err of Y Est		0.006288
R Squared		0.976569
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.338808	
Std Err of Coef.	0.004358	

POZZOLAN SPECIFIC GRAVITY	X COEFF-ICIENT m	Y INTER-CEPT c
2.6	0.3688664	1.3891796
2.7	0.3655011	1.4242418
2.8	0.3619777	1.4582349
2.9	0.3583232	1.4912017
3.0	0.3545611	1.5231834
3.1	0.3507118	1.5542193
3.2	0.3467931	1.5843472
3.3	0.3428207	1.6136033
3.4	0.3388082	1.6420219

LINEAR REGRESSION OF X COEFFICIENT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant		0.467390
Std Err of Y Est		0.000304
R Squared		0.999243
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	-0.037709	
Std Err of Coef.	0.000392	

LINEAR REGRESSION OF Y INTERCEPT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant		0.572678
Std Err of Y Est		0.003145
R Squared		0.998844
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	0.315783	
Std Err of Coef.	0.004060	

TABLE G-17

207C/CLARIFIER

OUT[illegible]ODUCT SPECIFIC GRAVITIES FOR DIFFERENT TDS & TSS CONDITIONS FOR A WATER TO POZZOLAN RATI[illegible]2

WITH CLARIFIER SILT AS PERCENTAGE OF TOTAL SILT = 30%

		SPECIFIC GRAVITY OF POZZOLANS				2.600	2.70	2.80	2.90	3.00	3.10	3.20	3.30	3.40
		SPECIFIC GRAVITY OF SALT				3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251
		SPECIFIC GRAVITY OF SILT				2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23
		SPECIFIC GRAVITY OF CLAR. SILT				2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73
		W/P RATIO				0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
		X(%)				30	30	30	30	30	30	30	30	30
TDS %	TSS %	SALT %	[illegible]	[illegible]	INPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.
0	0	0.00	0	0	1.000	1.765	1.797	1.827	1.857	1.885	1.912	1.939	1.964	1.988
0	2.5	0.00	0.75	1.75	1.015	1.768	1.800	1.830	1.860	1.888	1.915	1.941	1.966	1.991
0	5	0.00	1.5	3.5	1.030	1.772	1.803	1.834	1.863	1.891	1.918	1.944	1.969	1.993
0	7.5	0.00	2.25	5.25	1.045	1.775	1.807	1.837	1.866	1.894	1.921	1.947	1.972	1.996
0	10	0.00	3	7	1.061	1.779	1.810	1.840	1.869	1.897	1.924	1.950	1.974	1.998
0	12.5	0.00	3.75	8.75	1.078	1.783	1.814	1.844	1.873	1.900	1.927	1.953	1.977	2.001
0	15	0.00	4.5	10.5	1.095	1.787	1.818	1.848	1.876	1.904	1.930	1.956	1.980	2.004
2	0	2.00	0	0	1.014	1.770	1.801	1.832	1.861	1.890	1.917	1.943	1.969	1.993
2	2.5	1.95	0.75	1.75	1.029	1.773	1.805	1.835	1.864	1.893	1.920	1.946	1.971	1.995
2	5	1.90	1.5	3.5	1.044	1.777	1.808	1.838	1.868	1.896	1.923	1.949	1.974	1.998
2	7.5	1.85	2.25	5.25	1.059	1.780	1.812	1.842	1.871	1.899	1.926	1.951	1.976	2.000
2	10	1.80	3	7	1.075	1.784	1.815	1.845	1.874	1.902	1.929	1.954	1.979	2.003
2	12.5	1.75	3.75	8.75	1.092	1.788	1.819	1.849	1.878	1.905	1.932	1.957	1.982	2.006
2	15	1.70	4.5	10.5	1.109	1.792	1.823	1.853	1.881	1.909	1.935	1.961	1.985	2.009
4	0	4.00	0	0	1.028	1.775	1.806	1.837	1.866	1.895	1.922	1.948	1.973	1.998
4	2.5	3.90	0.75	1.75	1.043	1.778	1.810	1.840	1.869	1.898	1.925	1.951	1.976	2.000
4	5	3.80	1.5	3.5	1.058	1.782	1.813	1.843	1.873	1.901	1.928	1.954	1.979	2.003
4	7.5	3.70	2.25	5.25	1.074	1.785	1.817	1.847	1.876	1.904	1.931	1.956	1.981	2.005
4	10	3.60	3	7	1.090	1.789	1.820	1.850	1.879	1.907	1.934	1.959	1.984	2.008
4	12.5	3.50	3.75	8.75	1.107	1.793	1.824	1.854	1.883	1.910	1.937	1.962	1.987	2.011
4	15	3.40	4.5	10.5	1.124	1.797	1.828	1.858	1.886	1.914	1.940	1.966	1.990	2.014
6	0	6.00	0	0	1.043	1.780	1.812	1.842	1.872	1.900	1.927	1.953	1.978	2.003
6	2.5	5.85	0.75	1.75	1.058	1.783	1.815	1.845	1.875	1.903	1.930	1.956	1.981	2.005
6	5	5.70	1.5	3.5	1.073	1.787	1.818	1.849	1.878	1.906	1.933	1.959	1.984	2.008
6	7.5	5.55	2.25	5.25	1.089	1.791	1.822	1.852	1.881	1.909	1.936	1.961	1.986	2.010
6	10	5.40	3	7	1.105	1.795	1.826	1.856	1.884	1.912	1.939	1.964	1.989	2.013
6	12.5	5.25	3.75	8.75	1.122	1.799	1.830	1.859	1.888	1.916	1.942	1.967	1.992	2.016
6	15	5.10	4.5	10.5	1.139	1.803	1.834	1.863	1.892	1.919	1.945	1.971	1.995	2.019
8	0	8.00	0	0	1.059	1.785	1.817	1.847	1.877	1.905	1.932	1.958	1.984	2.008
8	2.5	7.80	0.75	1.75	1.073	1.789	1.820	1.851	1.880	1.908	1.935	1.961	1.986	2.010
8	5	7.60	1.5	3.5	1.089	1.792	1.824	1.854	1.883	1.911	1.938	1.964	1.989	2.013
8	7.5	7.40	2.25	5.25	1.104	1.796	1.827	1.857	1.886	1.914	1.941	1.967	1.992	2.015
8	10	7.20	3	7	1.120	1.800	1.831	1.861	1.890	1.917	1.944	1.970	1.994	2.018
8	12.5	7.00	3.75	8.75	1.137	1.804	1.835	1.865	1.893	1.921	1.947	1.973	1.997	2.021
8	15	6.80	4.5	10.5	1.154	1.808	1.839	1.869	1.897	1.924	1.951	1.976	2.000	2.024
10	0	10.00	0	0	1.074	1.791	1.823	1.853	1.882	1.910	1.938	1.964	1.989	2.013
10	2.5	9.75	0.75	1.75	1.089	1.794	1.826	1.856	1.885	1.913	1.940	1.966	1.992	2.016
10	5	9.50	1.5	3.5	1.104	1.798	1.829	1.860	1.889	1.917	1.943	1.969	1.994	2.018
10	7.5	9.25	2.25	5.25	1.120	1.802	1.833	1.863	1.892	1.920	1.946	1.972	1.997	2.021
10	10	9.00	3	7	1.136	1.806	1.837	1.867	1.895	1.923	1.950	1.975	2.000	2.023
10	12.5	8.75	3.75	8.75	1.153	1.810	1.841	1.870	1.899	1.926	1.953	1.978	2.003	2.026
10	15	8.50	4.5	10.5	1.170	1.814	1.845	1.874	1.903	1.930	1.956	1.981	2.006	2.029
12	0	12.00	0	0	1.091	1.797	1.828	1.859	1.888	1.916	1.943	1.969	1.995	2.019
12	2.5	11.70	0.75	1.75	1.105	1.800	1.832	1.862	1.891	1.919	1.946	1.972	1.997	2.021
12	5	11.40	1.5	3.5	1.121	1.804	1.835	1.865	1.894	1.922	1.949	1.975	2.000	2.024
12	7.5	11.10	2.25	5.25	1.136	1.808	1.839	1.869	1.898	1.925	1.952	1.978	2.002	2.026
12	10	10.80	3	7	1.153	1.812	1.843	1.873	1.901	1.929	1.955	1.981	2.005	2.029
12	12.5	10.50	3.75	8.75	1.169	1.816	1.847	1.876	1.905	1.932	1.959	1.984	2.008	2.032
12	15	10.20	4.5	10.5	1.186	1.820	1.851	1.880	1.909	1.936	1.962	1.987	2.011	2.035
14	0	14.00	0	0	1.107	1.803	1.834	1.865	1.894	1.922	1.949	1.975	2.000	2.025
14	2.5	13.65	0.75	1.75	1.122	1.806	1.838	1.868	1.897	1.925	1.952	1.978	2.003	2.027
14	5	13.30	1.5	3.5	1.138	1.810	1.841	1.871	1.900	1.928	1.955	1.981	2.006	2.029
14	7.5	12.95	2.25	5.25	1.153	1.814	1.845	1.875	1.904	1.931	1.958	1.984	2.008	2.032
14	10	12.60	3	7	1.169	1.818	1.849	1.879	1.907	1.935	1.961	1.987	2.011	2.035
14	12.5	12.25	3.75	8.75	1.186	1.822	1.853	1.882	1.911	1.938	1.964	1.990	2.014	2.038
14	15	11.90	4.5	10.5	1.203	1.826	1.857	1.886	1.915	1.942	1.968	1.993	2.017	2.040
16	0	16.00	0	0	1.125	1.809	1.841	1.871	1.900	1.928	1.955	1.981	2.006	2.031
16	2.5	15.60	0.75	1.75	1.139	1.813	1.844	1.874	1.903	1.931	1.958	1.984	2.009	2.033
16	5	15.20	1.5	3.5	1.155	1.816	1.848	1.878	1.906	1.934	1.961	1.987	2.012	2.035
16	7.5	14.80	2.25	5.25	1.171	1.820	1.851	1.881	1.910	1.937	1.964	1.990	2.014	2.038
16	10	14.40	3	7	1.187	1.824	1.855	1.885	1.913	1.941	1.967	1.993	2.017	2.041
16	12.5	14.00	3.75	8.75	1.203	1.828	1.859	1.889	1.917	1.944	1.971	1.996	2.020	2.043
16	15	13.60	4.5	10.5	1.220	1.833	1.863	1.893	1.921	1.948	1.974	1.999	2.023	2.046
18	0	18.00	0	0	1.142	1.815	1.847	1.877	1.906	1.935	1.961	1.987	2.013	2.037
18	2.5	17.55	0.75	1.75	1.157	1.819	1.850	1.881	1.910	1.938	1.964	1.990	2.015	2.039
18	5	17.10	1.5	3.5	1.173	1.823	1.854	1.884	1.913	1.941	1.967	1.993	2.018	2.042
18	7.5	16.65	2.25	5.25	1.188	1.827	1.858	1.888	1.916	1.944	1.970	1.996	2.020	2.044
18	10	16.20	3	7	1.205	1.831	1.862	1.891	1.920	1.947	1.974	1.999	2.023	2.047
18	12.5	15.75	3.75	8.75	1.221	1.835	1.866	1.895	1.924	1.951	1.977	2.002	2.026	2.050
18	15	15.30	4.5	10.5	1.238	1.839	1.870	1.899	1.927	1.954	1.980	2.005	2.029	2.053
20	0	20.00	0	0	1.161	1.822	1.854	1.884	1.913	1.941	1.968	1.994	2.019	2.043
20	2.5	19.50	0.75	1.75	1.176	1.826	1.857	1.887	1.916	1.944	1.971	1.997	2.022	2.045
20	5	19.00	1.5	3.5	1.191	1.830	1.861	1.891	1.920	1.947	1.974	2.000	2.024	2.048
20	7.5	18.50	2.25	5.25	1.207	1.834	1.865	1.894	1.923	1.951	1.977	2.002	2.027	2.051
20	10	18.00	3	7	1.223	1.838	1.868	1.898	1.927	1.954	1.980	2.005	2.030	2.053
20	12.5	17.50	3.75	8.75	1.239	1.842	1.873	1.902	1.930	1.957	1.983	2.009	2.033	2.056
20	15	17.00	4.5	10.5	1.257	1.846	1.877	1.906	1.934	1.961	1.987	2.012	2.036	2.059
22	0	22.00	0	0	1.180	1.829	1.861	1.891	1.920	1.948	1.975	2.001	2.026	2.050
22	2.5	21.45	0.75	1.75	1.195	1.833	1.864	1.894	1.923	1.951	1.978	2.003	2.028	2.052
22	5	20.90	1.5	3.5	1.210	1.837	1.868	1.898	1.927	1.954	1.981	2.006	2.031	2.055
22	7.5	20.35	2.25	5.25	1.226	1.841	1.872	1.901	1.930	1.957	1.984	2.009	2.034	2.057
22	10	19.80	3	7	1.242	1.845	1.876	1.905	1.934	1.961	1.987	2.012	2.036	2.060
22	12.5	19.25	3.75	8.75	1.258	1.849	1.880	1.909	1.937	1.964	1.990	2.015	2.039	2.063
22	15	18.70	4.5	10.5	1.275	1.853	1.884	1.913	1.941	1.968	1.994	2.019	2.043	2.066
24	0	24.00	0	0	1.199	1.837	1.868	1.898	1.927	1.955	1.982	2.008	2.033	2.057
24	2.5	23.40	0.75	1.75	1.214	1.840	1.872	1.902	1.930	1.958	1.985	2.011	2.035	2.059
24	5	22.80	1.5	3.5	1.230	1.844	1.875	1.905	1.934	1.961	1.988	2.013	2.038	2.062
24	7.5	22.20	2.25	5.25	1.245	1.848	1.879	1.909	1.937	1.965	1.991	2.016	2.041	2.064
24	10	21.60	3	7	1.261	1.852	1.883	1.912	1.941	1.968	1.994	2.019	2.043	2.067
24	12.5	21.00	3.75	8.75	1.278	1.856	1.887	1.916	1.944	1.971	1.997	2.022	2.046	2.070
24	15	20.40	4.5	10.5	1.295	1.861	1.891	1.920	1.948	1.975	2.001	2.026	2.049	2.072
26	0	26.00	0	0	1.220	1.844	1.876	1.906	1.935	1.963	1.989	2.015	2.040	2.064
26	2.5	25.35	0.75	1.75	1.234	1.848	1.879	1.909	1.938	1.966	1.992	2.018	2.043	2.066
26	5	24.70	1.5	3.5	1.250	1.852	1.883	1.913	1.941	1.969	1.995	2.021	2.045	2.069
26	7.5	24.05	2.25	5.25	1.265	1.856	1.887	1.916	1.945	1.972	1.998	2.024	2.048	2.071
26	10	23.40	3	7	1.281	1.860	1.891	1.920	1.948	1.975	2.002	2.027	2.051	2.074
26	12.5	22.75	3.75	8.75	1.298	1.864	1.895	1.924	1.952	1.979	2.005	2.030	2.054	2.077
26	15	22.10	4.5	10.5	1.315	1.869	1.899	1.928	1.956	1.983	2.008	2.033	2.057	2.080
28	0	28.00	0	0	1.240	1.852	1.884	1.914	1.943	1.970	1.997	2.023	2.048	2.071
28	2.5	27.30	0.75	1.75	1.255	1.856	1.887	1.917	1.946	1.973	2.000	2.026	2.050	2.074
28	5	26.60	1.5	3.5	1.271	1.860	1.891	1.921	1.949	1.977	2.003	2.028	2.053	2.076
28	7.5	25.90	2.25	5.25	1.286	1.864	1.895	1.924	1.953	1.980	2.006	2.031	2.055	2.079
28	10	25.20	3	7	1.302	1.868	1.899	1.928	1.956	1.983	2.009	2.034	2.058	2.081
28	12.5	24.50	3.75	8.75	1.319	1.872	1.903	1.932	1.960	1.987	2.013	2.037	2.061	2.084
28	15	23.80	4.5	10.5	1.336	1.877	1.907	1.936	1.964	1.990	2.016	2.041	2.064	2.087
30	0	30.00	0	0	1.262	1.861	1.892	1.922	1.951	1.978	2.005	2.031	2.056	2.079
30	2.5	29.25	0.75	1.75	1.277	1.864	1.895	1.925	1.954	1.982	2.008	2.033	2.058	2.082
30	5	28.50	1.5	3.5	1.292	1.868	1.899	1.929	1.957	1.985	2.011	2.036	2.061	2.084
30	7.5	27.75	2.25	5.25	1.308	1.872	1.903	1.932	1.961	1.988	2.014	2.039	2.063	2.087
30	10	27.00	3	7	1.324	1.876	1.907	1.936	1.964	1.991	2.017	2.042	2.066	2.089
30	12.5	26.25	3.75	8.75	1.340	1.881	1.911	1.940	1.968	1.995	2.021	2.045	2.069	2.092
30	15	25.50	4.5	10.5	1.357	1.885	1.915	1.944	1.972	1.999	2.024	2.049	2.072	2.095
32	0	32.00	0	0	1.285	1.869	1.901	1.931	1.959	1.987	2.014	2.039	2.064	2.088
32	2.5	31.20	0.75	1.75	1.299	1.873	1.904	1.934	1.963	1.990	2.016	2.042	2.066	2.090
32	5	30.40	1.5	3.5	1.315	1.877	1.908	1.937	1.966	1.993	2.019	2.045	2.069	2.092
32	7.5	29.60	2.25	5.25	1.330	1.881	1.912	1.941	1.969	1.996	2.022	2.047	2.072	2.095
32	10	28.80	3	7	1.346	1.885	1.916	1.945	1.973	2.000	2.026	2.050	2.074	2.097
32	12.5	28.00	3.75	8.75	1.362	1.890	1.920	1.949	1.977	2.003	2.029	2.054	2.077	2.100
32	15	27.20	4.5	10.5	1.379	1.894	1.924	1.953	1.981	2.007	2.032	2.057	2.080	2.103
34	0	34.00	0	0	1.308	1.878	1.910	1.940	1.968	1.996	2.022	2.048	2.072	2.096
34	2.5	33.15	0.75	1.75	1.323	1.882	1.913	1.943	1.971	1.999	2.025	2.051	2.075	2.098
34	5	32.30	1.5	3.5	1.338	1.886	1.917	1.946	1.975	2.002	2.028	2.053	2.078	2.101
34	7.5	31.45	2.25	5.25	1.353	1.890	1.921	1.950	1.978	2.005	2.031	2.056	2.080	2.103
34	10	30.60	3	7	1.369	1.894	1.925	1.954	1.982	2.009	2.034	2.059	2.083	2.106
34	12.5	29.75	3.75	8.75	1.385	1.899	1.929	1.958	1.986	2.012	2.038	2.062	2.086	2.108
34	15	28.90	4.5	10.5	1.402	1.903	1.933	1.962	1.989	2.016	2.041	2.065	2.089	2.111
36	0	36.00	0	0	1.332	1.888	1.919	1.949	1.978	2.005	2.032	2.057	2.081	2.105
36	2.5	35.10	0.75	1.75	1.347	1.892	1.923	1.952	1.981	2.008	2.034	2.060	2.084	2.107
36	5	34.20	1.5	3.5	1.362	1.896	1.926	1.956	1.984	2.011	2.037	2.062	2.087	2.110
36	7.5	33.30	2.25	5.25	1.377	1.900	1.930	1.960	1.988	2.015	2.040	2.065	2.089	2.112
36	10	32.40	3	7	1.393	1.904	1.934	1.963	1.991	2.018	2.044	2.068	2.092	2.115
36	12.5	31.50	3.75	8.75	1.409	1.908	1.938	1.967	1.995	2.021	2.047	2.071	2.095	2.117
36	15	30.60	4.5	10.5	1.425	1.913	1.943	1.971	1.999	2.025	2.050	2.074	2.098	2.120
38	0	38.00	0	0	1.357	1.898	1.929	1.959	1.987	2.015	2.041	2.067	2.091	2.114
38	2.5	37.05	0.75	1.75	1.372	1.902	1.933	1.962	1.991	2.018	2.044	2.069	2.093	2.117
38	5	36.10	1.5	3.5	1.387	1.906	1.936	1.966	1.994	2.021	2.047	2.072	2.096	2.119
38	7.5	35.15	2.25	5.25	1.402	1.910	1.940	1.969	1.997	2.024	2.050	2.075	2.099	2.121
38	10	34.20	3	7	1.417	1.914	1.944	1.973	2.001	2.028	2.053	2.078	2.101	2.124
38	12.5	33.25	3.75	8.75	1.433	1.918	1.948	1.977	2.005	2.031	2.056	2.081	2.104	2.127
38	15	32.30	4.5	10.5	1.449	1.923	1.953	1.981	2.009	2.035	2.060	2.084	2.107	2.129
40	0	40.00	0	0	1.383	1.909	1.940	1.969	1.998	2.025	2.051	2.077	2.101	2.124
40	2.5	39.00	0.75	1.75	1.398	1.912	1.943	1.973	2.001	2.028	2.054	2.079	2.103	2.127
40	5	38.00	1.5	3.5	1.412	1.916	1.947	1.976	2.004	2.031	2.057	2.082	2.106	2.129
40	7.5	37.00	2.25	5.25	1.427	1.920	1.951	1.980	2.008	2.034	2.060	2.085	2.108	2.131
40	10	36.00	3	7	1.443	1.925	1.955	1.984	2.011	2.038	2.063	2.088	2.111	2.134
40	12.5	35.00	3.75	8.75	1.459	1.929	1.959	1.988	2.015	2.041	2.066	2.091	2.114	2.136
40	15	34.00	4.5	10.5	1.475	1.934	1.963	1.992	2.019	2.045	2.070	2.094	2.117	2.139

LINEAR REGRESSION OF INPUT SP. GR. vS OUTPUT SP. GR.

For Pozzolan Sp. Gr. of 2.6

Regression Output:

Constant		1.388535
Std Err of Y Est		0.004025
R Squared		0.991857
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.369754	
Std Err of Coef.	0.002782	

For Pozzolan Sp. Gr. of 2.7

Regression Output:

Constant		1.423553
Std Err of Y Est		0.004264
R Squared		0.990711
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.366449	
Std Err of Coef.	0.002947	

For Pozzolan Sp. Gr. of 2.8

Regression Output:

Constant		1.457503
Std Err of Y Est		0.004501
R Squared		0.989463
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.362985	
Std Err of Coef.	0.003111	

For Pozzolan Sp. Gr. of 2.9

Regression Output:

Constant		1.490428
Std Err of Y Est		0.004736
R Squared		0.988113
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.359388	
Std Err of Coef.	0.003273	

For Pozzolan Sp. Gr. of 3.0

Regression Output:

Constant		1.522368
Std Err of Y Est		0.004970
R Squared		0.986659
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.355683	
Std Err of Coef.	0.003435	

For Pozzolan Sp. Gr. of 3.1

Regression Output:

Constant		1.553364080543
Std Err of Y Est		0.0052002909398857
R Squared		0.98509827391646
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.351889	
Std Err of Coef.	0.003594	

For Pozzolan Sp. Gr. of 3.2

Regression Output:

Constant		1.5834530459272
Std Err of Y Est		0.0054279769438458
R Squared		0.98343035055588
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.348024	
Std Err of Coef.	0.003752	

For Pozzolan Sp. Gr. of 3.3

Regression Output:

Constant		1.6126711089106
Std Err of Y Est		0.0056524199863649
R Squared		0.98165327076979
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.344105	
Std Err of Coef.	0.003907	

For Pozzolan Sp. Gr. of 3.4

Regression Output:

Constant		1.641053
Std Err of Y Est		0.005873
R Squared		0.979765
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.340144	
Std Err of Coef.	0.004059	

POZZOLAN SPECIFIC GRAVITY	X COEFF-ICIENT m	Y INTER-CEPT c
2.6	0.3697536	1.3885349
2.7	0.3664488	1.4235529
2.8	0.3629847	1.4575028
2.9	0.3593882	1.4904275
3.0	0.3556827	1.5223681
3.1	0.3518887	1.5533641
3.2	0.3480241	1.5834530
3.3	0.3441045	1.6126711
3.4	0.3401435	1.6410527

LINEAR REGRESSION OF X COEFFICIENT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant		0.466827
Std Err of Y Est		0.000308
R Squared		0.999198
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	-0.037149	
Std Err of Coef.	0.000398	

LINEAR REGRESSION OF Y INTERCEPT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant		0.573082
Std Err of Y Est		0.003142
R Squared		0.998644
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	0.315377	
Std Err of Coef.	0.004056	

TABLE G-18

207C/CLARIFIER

OUT[illegible]DUCT SPECIFIC GRAVITIES FOR DIFFERENT TDS & TSS CONDITIONS FOR A WATER TO POZZOLAN RATI[illegible]2

WITH CLARIFIER SILT AS PERCENTAGE OF TOTAL SILT = 40%

		SPECIFIC GRAVITY OF POZZOLANS				2.600	2.70	2.80	2.90	3.00	3.10	3.20	3.30	3.40
		SPECIFIC GRAVITY OF SALT				3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251
		SPECIFIC GRAVITY OF SILT				2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23
		SPECIFIC GRAVITY OF CLAR. SILT				2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73
		W/P RATIO				0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
		D(%)				40	40	40	40	40	40	40	40	40
TDS %	TSS %	SALT %	CLAR SILT	TSPC SILT	INPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.
0	0	0.00	0	0	1.000	1.765	1.797	1.827	1.857	1.885	1.912	1.939	1.964	1.988
0	2.5	0.00	1	1.5	1.015	1.768	1.800	1.831	1.860	1.888	1.915	1.941	1.967	1.991
0	5	0.00	2	3	1.030	1.772	1.804	1.834	1.863	1.891	1.918	1.944	1.970	1.994
0	7.5	0.00	3	4.5	1.046	1.776	1.807	1.838	1.867	1.895	1.921	1.947	1.972	1.997
0	10	0.00	4	6	1.062	1.780	1.811	1.841	1.870	1.898	1.925	1.951	1.976	2.000
0	12.5	0.00	5	7.5	1.079	1.784	1.815	1.845	1.874	1.902	1.928	1.954	1.979	2.003
0	15	0.00	6	9	1.096	1.788	1.819	1.849	1.878	1.905	1.932	1.957	1.982	2.006
2	0	2.00	0	0	1.014	1.770	1.801	1.832	1.861	1.890	1.917	1.943	1.969	1.993
2	2.5	1.95	1	1.5	1.029	1.773	1.805	1.835	1.865	1.893	1.920	1.946	1.971	1.996
2	5	1.90	2	3	1.044	1.777	1.809	1.839	1.868	1.896	1.923	1.949	1.974	1.998
2	7.5	1.85	3	4.5	1.060	1.781	1.812	1.842	1.871	1.899	1.926	1.952	1.977	2.001
2	10	1.80	4	6	1.076	1.785	1.816	1.846	1.875	1.903	1.930	1.955	1.980	2.004
2	12.5	1.75	5	7.5	1.093	1.789	1.820	1.850	1.879	1.907	1.933	1.959	1.983	2.007
2	15	1.70	6	9	1.110	1.794	1.825	1.854	1.883	1.910	1.937	1.962	1.987	2.010
4	0	4.00	0	0	1.028	1.775	1.806	1.837	1.866	1.895	1.922	1.948	1.973	1.998
4	2.5	3.90	1	1.5	1.043	1.778	1.810	1.840	1.870	1.898	1.925	1.951	1.976	2.001
4	5	3.80	2	3	1.059	1.782	1.814	1.844	1.873	1.901	1.928	1.954	1.979	2.003
4	7.5	3.70	3	4.5	1.075	1.786	1.817	1.848	1.877	1.904	1.931	1.957	1.982	2.006
4	10	3.60	4	6	1.091	1.790	1.821	1.851	1.880	1.908	1.935	1.960	1.985	2.009
4	12.5	3.50	5	7.5	1.108	1.794	1.825	1.855	1.884	1.912	1.938	1.964	1.988	2.012
4	15	3.40	6	9	1.125	1.799	1.830	1.859	1.888	1.915	1.942	1.967	1.992	2.015
6	0	6.00	0	0	1.043	1.780	1.812	1.842	1.872	1.900	1.927	1.953	1.978	2.003
6	2.5	5.85	1	1.5	1.058	1.784	1.815	1.846	1.875	1.903	1.930	1.956	1.981	2.006
6	5	5.70	2	3	1.074	1.787	1.819	1.849	1.878	1.906	1.933	1.959	1.984	2.008
6	7.5	5.55	3	4.5	1.090	1.791	1.823	1.853	1.882	1.910	1.936	1.962	1.987	2.011
6	10	5.40	4	6	1.106	1.795	1.827	1.857	1.885	1.913	1.940	1.965	1.990	2.014
6	12.5	5.25	5	7.5	1.123	1.800	1.831	1.861	1.889	1.917	1.943	1.969	1.993	2.017
6	15	5.10	6	9	1.140	1.804	1.835	1.865	1.893	1.921	1.947	1.972	1.997	2.020
8	0	8.00	0	0	1.059	1.785	1.817	1.847	1.877	1.905	1.932	1.958	1.984	2.008
8	2.5	7.80	1	1.5	1.074	1.789	1.821	1.851	1.880	1.908	1.935	1.961	1.986	2.011
8	5	7.60	2	3	1.089	1.793	1.824	1.854	1.884	1.911	1.938	1.964	1.989	2.013
8	7.5	7.40	3	4.5	1.105	1.797	1.828	1.858	1.887	1.915	1.942	1.967	1.992	2.016
8	10	7.20	4	6	1.121	1.801	1.832	1.862	1.891	1.918	1.945	1.971	1.995	2.019
8	12.5	7.00	5	7.5	1.138	1.805	1.836	1.866	1.895	1.922	1.949	1.974	1.999	2.022
8	15	6.80	6	9	1.156	1.810	1.841	1.870	1.899	1.926	1.952	1.978	2.002	2.026
10	0	10.00	0	0	1.074	1.791	1.823	1.853	1.882	1.910	1.938	1.964	1.989	2.013
10	2.5	9.75	1	1.5	1.089	1.795	1.826	1.856	1.886	1.914	1.941	1.967	1.992	2.016
10	5	9.50	2	3	1.105	1.798	1.830	1.860	1.889	1.917	1.944	1.970	1.995	2.019
10	7.5	9.25	3	4.5	1.121	1.802	1.834	1.864	1.893	1.920	1.947	1.973	1.998	2.022
10	10	9.00	4	6	1.137	1.807	1.838	1.868	1.896	1.924	1.951	1.976	2.001	2.025
10	12.5	8.75	5	7.5	1.154	1.811	1.842	1.872	1.900	1.928	1.954	1.980	2.004	2.028
10	15	8.50	6	9	1.172	1.816	1.846	1.876	1.904	1.932	1.958	1.983	2.008	2.031
12	0	12.00	0	0	1.091	1.797	1.828	1.859	1.888	1.916	1.943	1.969	1.995	2.019
12	2.5	11.70	1	1.5	1.106	1.800	1.832	1.862	1.891	1.919	1.946	1.972	1.997	2.022
12	5	11.40	2	3	1.121	1.804	1.836	1.866	1.895	1.923	1.950	1.975	2.000	2.024
12	7.5	11.10	3	4.5	1.137	1.808	1.840	1.870	1.898	1.926	1.953	1.979	2.003	2.027
12	10	10.80	4	6	1.154	1.813	1.844	1.874	1.902	1.930	1.956	1.982	2.006	2.030
12	12.5	10.50	5	7.5	1.171	1.817	1.848	1.878	1.906	1.934	1.960	1.985	2.010	2.033
12	15	10.20	6	9	1.188	1.822	1.852	1.882	1.910	1.937	1.964	1.989	2.013	2.037
14	0	14.00	0	0	1.107	1.803	1.834	1.865	1.894	1.922	1.949	1.975	2.000	2.025
14	2.5	13.65	1	1.5	1.122	1.806	1.838	1.868	1.897	1.925	1.952	1.978	2.003	2.027
14	5	13.30	2	3	1.138	1.810	1.842	1.872	1.901	1.929	1.955	1.981	2.006	2.030
14	7.5	12.95	3	4.5	1.154	1.814	1.846	1.876	1.904	1.932	1.959	1.984	2.009	2.033
14	10	12.60	4	6	1.171	1.819	1.850	1.880	1.908	1.936	1.962	1.988	2.012	2.036
14	12.5	12.25	5	7.5	1.187	1.823	1.854	1.884	1.912	1.940	1.966	1.991	2.016	2.039
14	15	11.90	6	9	1.205	1.828	1.859	1.888	1.916	1.943	1.970	1.995	2.019	2.042
16	0	16.00	0	0	1.125	1.809	1.841	1.871	1.900	1.928	1.955	1.981	2.006	2.031
16	2.5	15.60	1	1.5	1.140	1.813	1.844	1.874	1.903	1.931	1.958	1.984	2.009	2.033
16	5	15.20	2	3	1.155	1.817	1.848	1.878	1.907	1.935	1.962	1.987	2.012	2.036
16	7.5	14.80	3	4.5	1.171	1.821	1.852	1.882	1.911	1.938	1.965	1.990	2.015	2.039
16	10	14.40	4	6	1.188	1.825	1.856	1.886	1.914	1.942	1.968	1.994	2.018	2.042
16	12.5	14.00	5	7.5	1.205	1.830	1.860	1.890	1.918	1.946	1.972	1.997	2.022	2.045
16	15	13.60	6	9	1.222	1.834	1.865	1.894	1.923	1.950	1.976	2.001	2.025	2.048
18	0	18.00	0	0	1.142	1.815	1.847	1.877	1.906	1.935	1.961	1.987	2.013	2.037
18	2.5	17.55	1	1.5	1.158	1.819	1.851	1.881	1.910	1.938	1.965	1.990	2.015	2.039
18	5	17.10	2	3	1.173	1.823	1.855	1.885	1.913	1.941	1.968	1.994	2.018	2.042
18	7.5	16.65	3	4.5	1.189	1.827	1.859	1.888	1.917	1.945	1.971	1.997	2.021	2.045
18	10	16.20	4	6	1.206	1.832	1.863	1.892	1.921	1.948	1.975	2.000	2.025	2.048
18	12.5	15.75	5	7.5	1.223	1.836	1.867	1.897	1.925	1.952	1.978	2.004	2.028	2.051
18	15	15.30	6	9	1.240	1.841	1.872	1.901	1.929	1.956	1.982	2.007	2.031	2.054
20	0	20.00	0	0	1.161	1.822	1.854	1.884	1.913	1.941	1.968	1.994	2.019	2.043
20	2.5	19.50	1	1.5	1.176	1.826	1.857	1.888	1.917	1.944	1.971	1.997	2.022	2.046
20	5	19.00	2	3	1.192	1.830	1.861	1.891	1.920	1.948	1.974	2.000	2.025	2.049
20	7.5	18.50	3	4.5	1.208	1.834	1.865	1.895	1.924	1.951	1.978	2.003	2.028	2.052
20	10	18.00	4	6	1.224	1.839	1.870	1.899	1.928	1.955	1.981	2.007	2.031	2.055
20	12.5	17.50	5	7.5	1.241	1.843	1.874	1.903	1.932	1.959	1.985	2.010	2.034	2.058
20	15	17.00	6	9	1.258	1.848	1.878	1.908	1.936	1.963	1.989	2.014	2.038	2.061
22	0	22.00	0	0	1.180	1.829	1.861	1.891	1.920	1.948	1.975	2.001	2.026	2.050
22	2.5	21.45	1	1.5	1.195	1.833	1.864	1.895	1.923	1.951	1.978	2.004	2.029	2.052
22	5	20.90	2	3	1.211	1.837	1.868	1.898	1.927	1.955	1.981	2.007	2.032	2.055
22	7.5	20.35	3	4.5	1.227	1.841	1.872	1.902	1.931	1.958	1.985	2.010	2.035	2.058
22	10	19.80	4	6	1.243	1.846	1.877	1.906	1.935	1.962	1.988	2.013	2.038	2.061
22	12.5	19.25	5	7.5	1.260	1.850	1.881	1.910	1.939	1.966	1.992	2.017	2.041	2.064
22	15	18.70	6	9	1.277	1.855	1.886	1.915	1.943	1.970	1.996	2.021	2.045	2.068
24	0	24.00	0	0	1.199	1.837	1.868	1.898	1.927	1.955	1.982	2.008	2.033	2.057
24	2.5	23.40	1	1.5	1.215	1.840	1.872	1.902	1.931	1.958	1.985	2.011	2.036	2.059
24	5	22.80	2	3	1.230	1.845	1.876	1.906	1.934	1.962	1.988	2.014	2.039	2.062
24	7.5	22.20	3	4.5	1.246	1.849	1.880	1.910	1.938	1.965	1.992	2.017	2.042	2.065
24	10	21.60	4	6	1.263	1.853	1.884	1.914	1.942	1.969	1.995	2.021	2.045	2.068
24	12.5	21.00	5	7.5	1.280	1.858	1.888	1.918	1.946	1.973	1.999	2.024	2.048	2.071
24	15	20.40	6	9	1.297	1.863	1.893	1.922	1.950	1.977	2.003	2.028	2.052	2.075
26	0	26.00	0	0	1.220	1.844	1.876	1.906	1.935	1.963	1.989	2.015	2.040	2.064
26	2.5	25.35	1	1.5	1.235	1.848	1.879	1.909	1.938	1.966	1.993	2.018	2.043	2.067
26	5	24.70	2	3	1.250	1.852	1.883	1.913	1.942	1.969	1.996	2.021	2.046	2.069
26	7.5	24.05	3	4.5	1.266	1.857	1.887	1.917	1.946	1.973	1.999	2.025	2.049	2.072
26	10	23.40	4	6	1.283	1.861	1.892	1.921	1.950	1.977	2.003	2.028	2.052	2.075
26	12.5	22.75	5	7.5	1.300	1.866	1.896	1.925	1.954	1.981	2.006	2.031	2.055	2.078
26	15	22.10	6	9	1.317	1.870	1.901	1.930	1.958	1.985	2.010	2.035	2.059	2.082
28	0	28.00	0	0	1.240	1.852	1.884	1.914	1.943	1.970	1.997	2.023	2.048	2.071
28	2.5	27.30	1	1.5	1.256	1.856	1.887	1.917	1.946	1.974	2.000	2.026	2.050	2.074
28	5	26.60	2	3	1.271	1.860	1.891	1.921	1.950	1.977	2.004	2.029	2.053	2.077
28	7.5	25.90	3	4.5	1.287	1.865	1.895	1.925	1.953	1.981	2.007	2.032	2.056	2.080
28	10	25.20	4	6	1.304	1.869	1.900	1.929	1.957	1.985	2.011	2.036	2.060	2.083
28	12.5	24.50	5	7.5	1.320	1.874	1.904	1.933	1.961	1.988	2.014	2.039	2.063	2.086
28	15	23.80	6	9	1.338	1.879	1.909	1.938	1.966	1.992	2.018	2.043	2.066	2.089
30	0	30.00	0	0	1.262	1.861	1.892	1.922	1.951	1.978	2.005	2.031	2.056	2.079
30	2.5	29.25	1	1.5	1.277	1.865	1.896	1.926	1.954	1.982	2.008	2.034	2.058	2.082
30	5	28.50	2	3	1.293	1.869	1.900	1.929	1.958	1.985	2.012	2.037	2.061	2.085
30	7.5	27.75	3	4.5	1.309	1.873	1.904	1.933	1.962	1.989	2.015	2.040	2.064	2.088
30	10	27.00	4	6	1.325	1.878	1.908	1.937	1.966	1.993	2.019	2.044	2.068	2.091
30	12.5	26.25	5	7.5	1.342	1.882	1.913	1.942	1.970	1.997	2.022	2.047	2.071	2.094
30	15	25.50	6	9	1.359	1.887	1.917	1.946	1.974	2.001	2.026	2.051	2.074	2.097
32	0	32.00	0	0	1.285	1.869	1.901	1.931	1.959	1.987	2.014	2.039	2.064	2.088
32	2.5	31.20	1	1.5	1.300	1.873	1.904	1.934	1.963	1.990	2.017	2.042	2.067	2.090
32	5	30.40	2	3	1.315	1.877	1.908	1.938	1.966	1.994	2.020	2.045	2.070	2.093
32	7.5	29.60	3	4.5	1.331	1.882	1.913	1.942	1.970	1.997	2.023	2.049	2.073	2.096
32	10	28.80	4	6	1.347	1.886	1.917	1.946	1.974	2.001	2.027	2.052	2.076	2.099
32	12.5	28.00	5	7.5	1.364	1.891	1.921	1.950	1.978	2.005	2.031	2.055	2.079	2.102
32	15	27.20	6	9	1.381	1.896	1.926	1.955	1.983	2.009	2.035	2.059	2.082	2.105
34	0	34.00	0	0	1.308	1.878	1.910	1.940	1.968	1.996	2.022	2.048	2.072	2.096
34	2.5	33.15	1	1.5	1.323	1.882	1.913	1.943	1.972	1.999	2.026	2.051	2.075	2.099
34	5	32.30	2	3	1.338	1.887	1.918	1.947	1.975	2.003	2.029	2.054	2.078	2.102
34	7.5	31.45	3	4.5	1.354	1.891	1.922	1.951	1.979	2.006	2.032	2.057	2.081	2.104
34	10	30.60	4	6	1.370	1.896	1.926	1.955	1.983	2.010	2.036	2.061	2.084	2.107
34	12.5	29.75	5	7.5	1.387	1.900	1.931	1.960	1.987	2.014	2.039	2.064	2.088	2.110
34	15	28.90	6	9	1.404	1.905	1.935	1.964	1.992	2.018	2.043	2.068	2.091	2.114
36	0	36.00	0	0	1.332	1.888	1.919	1.949	1.978	2.005	2.032	2.057	2.081	2.105
36	2.5	35.10	1	1.5	1.347	1.892	1.923	1.953	1.981	2.009	2.035	2.060	2.084	2.108
36	5	34.20	2	3	1.362	1.896	1.927	1.957	1.985	2.012	2.038	2.063	2.087	2.110
36	7.5	33.30	3	4.5	1.378	1.901	1.931	1.961	1.989	2.016	2.041	2.066	2.090	2.113
36	10	32.40	4	6	1.394	1.905	1.936	1.965	1.993	2.019	2.045	2.070	2.093	2.116
36	12.5	31.50	5	7.5	1.411	1.910	1.940	1.969	1.997	2.023	2.049	2.073	2.097	2.119
36	15	30.60	6	9	1.428	1.915	1.945	1.973	2.001	2.027	2.052	2.077	2.100	2.122
38	0	38.00	0	0	1.357	1.898	1.929	1.959	1.987	2.015	2.041	2.067	2.091	2.114
38	2.5	37.05	1	1.5	1.372	1.902	1.933	1.963	1.991	2.018	2.044	2.070	2.094	2.117
38	5	36.10	2	3	1.387	1.906	1.937	1.966	1.995	2.022	2.048	2.073	2.097	2.120
38	7.5	35.15	3	4.5	1.403	1.911	1.941	1.970	1.998	2.025	2.051	2.076	2.100	2.123
38	10	34.20	4	6	1.419	1.915	1.946	1.975	2.002	2.029	2.055	2.079	2.103	2.126
38	12.5	33.25	5	7.5	1.435	1.920	1.950	1.979	2.006	2.033	2.058	2.083	2.106	2.129
38	15	32.30	6	9	1.452	1.925	1.955	1.983	2.011	2.037	2.062	2.086	2.109	2.132
40	0	40.00	0	0	1.383	1.909	1.940	1.969	1.998	2.025	2.051	2.077	2.101	2.124
40	2.5	39.00	1	1.5	1.398	1.913	1.943	1.973	2.001	2.028	2.055	2.080	2.104	2.127
40	5	38.00	2	3	1.413	1.917	1.948	1.977	2.005	2.032	2.058	2.083	2.107	2.130
40	7.5	37.00	3	4.5	1.429	1.921	1.952	1.981	2.009	2.036	2.061	2.086	2.110	2.132
40	10	36.00	4	6	1.444	1.926	1.956	1.985	2.013	2.039	2.065	2.089	2.113	2.135
40	12.5	35.00	5	7.5	1.461	1.931	1.961	1.989	2.017	2.043	2.068	2.093	2.116	2.138
40	15	34.00	6	9	1.477	1.936	1.965	1.994	2.021	2.047	2.072	2.096	2.119	2.141

LINEAR REGRESSION OF INPUT SP. GR. vS OUTPUT SP. GR.

For Pozzolan Sp. Gr. of 2.6

Regression Output:

Constant		1.387865
Std Err of Y Est		0.003764
R Squared		0.992947
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.370660	
Std Err of Coef.	0.002594	

For Pozzolan Sp. Gr. of 2.7

Regression Output:

Constant		1.422837
Std Err of Y Est		0.003982
R Squared		0.991977
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.367418	
Std Err of Coef.	0.002744	

For Pozzolan Sp. Gr. of 2.8

Regression Output:

Constant		1.456742
Std Err of Y Est		0.004199
R Squared		0.990921
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.364014	
Std Err of Coef.	0.002894	

For Pozzolan Sp. Gr. of 2.9

Regression Output:

Constant		1.489622
Std Err of Y Est		0.004415
R Squared		0.989776
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.360477	
Std Err of Coef.	0.003042	

For Pozzolan Sp. Gr. of 3.0

Regression Output:

Constant		1.521520
Std Err of Y Est		0.004629
R Squared		0.988543
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.356830	
Std Err of Coef.	0.003190	

For Pozzolan Sp. Gr. of 3.1

Regression Output:

Constant		1.552474454247
Std Err of Y Est		0.0048413076558472
R Squared		0.98721969037418
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.353092	
Std Err of Coef.	0.003336	

For Pozzolan Sp. Gr. of 3.2

Regression Output:

Constant		1.5825227402644
Std Err of Y Est		0.0050509134168706
R Squared		0.98580438923892
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.349283	
Std Err of Coef.	0.003481	

For Pozzolan Sp. Gr. of 3.3

Regression Output:

Constant		1.6117011563815
Std Err of Y Est		0.0052577318772184
R Squared		0.98429593019554
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.345418	
Std Err of Coef.	0.003623	

For Pozzolan Sp. Gr. of 3.4

Regression Output:

Constant		1.640044
Std Err of Y Est		0.005462
R Squared		0.982693
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.341510	
Std Err of Coef.	0.003764	

POZZOLAN SPECIFIC GRAVITY	X COEFF-ICIENT m	Y INTER-CEPT c
2.6	0.3706603	1.3878648
2.7	0.3674176	1.4228367
2.8	0.3640142	1.4567416
2.9	0.3604771	1.4896224
3.0	0.3568297	1.5215203
3.1	0.3530924	1.5524745
3.2	0.3492833	1.5825227
3.3	0.3454178	1.6117012
3.4	0.3415097	1.6400441

LINEAR REGRESSION OF X COEFFICIENT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant		0.466247
Std Err of Y Est		0.000313
R Squared		0.999149
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	-0.036575	
Std Err of Coef.	0.000403	

LINEAR REGRESSION OF Y INTERCEPT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant		0.573507
Std Err of Y Est		0.003138
R Squared		0.998843
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	0.314954	
Std Err of Coef.	0.004051	

207C/CLARIFIER

OUTPUT PRODUCT SPECIFIC GRAVITIES FOR DIFFERENT TDS & TSS CONDITIONS FOR A WATER TO POZZOLAN RATIO OF 0.42
WITH CLARIFIER SILT AS PERCENTAGE OF TOTAL SILT = 50%

SPECIFIC GRAVITY OF POZZOLANS						2.600	2.70	2.80	2.90	3.00	3.10	3.20	[illegible]	3.40
SPECIFIC GRAVITY OF SALT						3.251	3.251	3.251	3.251	3.251	3.251	3.251	[illegible]	3.251
SPECIFIC GRAVITY OF SILT						2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23
SPECIFIC GRAVITY OF CLAR. SILT						2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73
W/P RATIO						0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
X(%)						50	50	50	50	50	50	50	50	50
TDS %	TSS %	SALT %	CLAR SILT	WPC SILT	INPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.
0	0	0.00	0	0	1.000	1.765	1.797	1.827	1.857	1.885	1.912	1.939	1.964	1.988
0	2.5	0.00	1.25	1.25	1.015	1.769	1.800	1.831	1.860	1.888	1.915	1.942	1.967	1.991
0	5	0.00	2.5	2.5	1.031	1.772	1.804	1.834	1.864	1.892	1.919	1.945	1.970	1.994
0	7.5	0.00	3.75	3.75	1.047	1.777	1.808	1.838	1.867	1.895	1.922	1.948	1.973	1.997
0	10	0.00	5	5	1.063	1.781	1.812	1.842	1.871	1.899	1.926	1.952	1.977	2.001
0	12.5	0.00	6.25	6.25	1.080	1.785	1.816	1.846	1.875	1.903	1.930	1.955	1.980	2.004
0	15	0.00	7.5	7.5	1.098	1.790	1.821	1.851	1.879	1.907	1.933	1.959	1.984	2.007
2	0	2.00	0	0	1.014	1.770	1.801	1.832	1.861	1.890	1.917	1.943	1.969	1.993
2	2.5	1.95	1.25	1.25	1.029	1.773	1.805	1.836	1.865	1.893	1.920	1.946	1.972	1.996
2	5	1.90	2.5	2.5	1.045	1.777	1.809	1.839	1.868	1.897	1.924	1.950	1.975	1.999
2	7.5	1.85	3.75	3.75	1.061	1.781	1.813	1.843	1.872	1.900	1.927	1.953	1.978	2.002
2	10	1.80	5	5	1.077	1.786	1.817	1.847	1.876	1.904	1.931	1.956	1.981	2.005
2	12.5	1.75	6.25	6.25	1.094	1.790	1.821	1.851	1.880	1.908	1.934	1.960	1.985	2.009
2	15	1.70	7.5	7.5	1.112	1.795	1.826	1.856	1.884	1.912	1.938	1.964	1.988	2.012
4	0	4.00	0	0	1.028	1.775	1.806	1.837	1.866	1.895	1.922	1.948	1.973	1.998
4	2.5	3.90	1.25	1.25	1.044	1.779	1.810	1.841	1.870	1.898	1.925	1.951	1.976	2.001
4	5	3.80	2.5	2.5	1.059	1.782	1.814	1.844	1.873	1.901	1.928	1.955	1.980	2.004
4	7.5	3.70	3.75	3.75	1.075	1.787	1.818	1.848	1.877	1.905	1.932	1.958	1.983	2.007
4	10	3.60	5	5	1.092	1.791	1.822	1.852	1.881	1.909	1.936	1.961	1.986	2.010
4	12.5	3.50	6.25	6.25	1.109	1.795	1.827	1.856	1.885	1.913	1.939	1.965	1.990	2.014
4	15	3.40	7.5	7.5	1.127	1.800	1.831	1.861	1.889	1.917	1.943	1.969	1.993	2.017
6	0	6.00	0	0	1.043	1.780	1.812	1.842	1.872	1.900	1.927	1.953	1.978	2.003
6	2.5	5.85	1.25	1.25	1.059	1.784	1.815	1.846	1.875	1.903	1.930	1.956	1.981	2.006
6	5	5.70	2.5	2.5	1.074	1.788	1.819	1.850	1.879	1.907	1.934	1.960	1.985	2.009
6	7.5	5.55	3.75	3.75	1.090	1.792	1.823	1.853	1.882	1.910	1.937	1.963	1.988	2.012
6	10	5.40	5	5	1.107	1.796	1.828	1.858	1.886	1.914	1.941	1.967	1.991	2.015
6	12.5	5.25	6.25	6.25	1.124	1.801	1.832	1.862	1.890	1.918	1.945	1.970	1.995	2.019
6	15	5.10	7.5	7.5	1.142	1.806	1.837	1.866	1.895	1.922	1.949	1.974	1.999	2.022
8	0	8.00	0	0	1.059	1.785	1.817	1.847	1.877	1.905	1.932	1.958	1.984	2.008
8	2.5	7.80	1.25	1.25	1.074	1.789	1.821	1.851	1.880	1.908	1.935	1.962	1.987	2.011
8	5	7.60	2.5	2.5	1.090	1.793	1.825	1.855	1.884	1.912	1.939	1.965	1.990	2.014
8	7.5	7.40	3.75	3.75	1.106	1.797	1.829	1.859	1.888	1.916	1.942	1.968	1.993	2.017
8	10	7.20	5	5	1.122	1.802	1.833	1.863	1.892	1.919	1.946	1.972	1.997	2.020
8	12.5	7.00	6.25	6.25	1.140	1.806	1.837	1.867	1.896	1.923	1.950	1.976	2.000	2.024
8	15	6.80	7.5	7.5	1.157	1.811	1.842	1.872	1.900	1.928	1.954	1.979	2.004	2.027
10	0	10.00	0	0	1.074	1.791	1.823	1.853	1.882	1.910	1.938	1.964	1.989	2.013
10	2.5	9.75	1.25	1.25	1.090	1.795	1.826	1.857	1.886	1.914	1.941	1.967	1.992	2.016
10	5	9.50	2.5	2.5	1.105	1.799	1.830	1.861	1.890	1.918	1.944	1.970	1.995	2.019
10	7.5	9.25	3.75	3.75	1.122	1.803	1.834	1.865	1.893	1.921	1.948	1.974	1.999	2.022
10	10	9.00	5	5	1.138	1.808	1.839	1.869	1.897	1.925	1.952	1.977	2.002	2.026
10	12.5	8.75	6.25	6.25	1.156	1.812	1.843	1.873	1.902	1.929	1.956	1.981	2.006	2.029
10	15	8.50	7.5	7.5	1.173	1.817	1.848	1.877	1.906	1.933	1.960	1.985	2.009	2.033
12	0	12.00	0	0	1.091	1.797	1.828	1.859	1.888	1.916	1.943	1.969	1.995	2.019
12	2.5	11.70	1.25	1.25	1.106	1.801	1.832	1.862	1.892	1.920	1.947	1.973	1.998	2.022
12	5	11.40	2.5	2.5	1.122	1.805	1.836	1.866	1.895	1.923	1.950	1.976	2.001	2.025
12	7.5	11.10	3.75	3.75	1.138	1.809	1.840	1.870	1.899	1.927	1.954	1.979	2.004	2.028
12	10	10.80	5	5	1.155	1.814	1.845	1.875	1.903	1.931	1.957	1.983	2.008	2.031
12	12.5	10.50	6.25	6.25	1.172	1.818	1.849	1.879	1.907	1.935	1.961	1.987	2.011	2.035
12	15	10.20	7.5	7.5	1.190	1.823	1.854	1.883	1.912	1.939	1.965	1.991	2.015	2.038
14	0	14.00	0	0	1.107	1.803	1.834	1.865	1.894	1.922	1.949	1.975	2.000	2.025
14	2.5	13.65	1.25	1.25	1.123	1.807	1.838	1.868	1.898	1.926	1.952	1.978	2.003	2.028
14	5	13.30	2.5	2.5	1.139	1.811	1.842	1.872	1.901	1.929	1.956	1.982	2.007	2.031
14	7.5	12.95	3.75	3.75	1.155	1.815	1.846	1.876	1.905	1.933	1.960	1.985	2.010	2.034
14	10	12.60	5	5	1.172	1.820	1.851	1.881	1.909	1.937	1.963	1.989	2.013	2.037
14	12.5	12.25	6.25	6.25	1.189	1.824	1.855	1.885	1.914	1.941	1.967	1.993	2.017	2.041
14	15	11.90	7.5	7.5	1.207	1.829	1.860	1.890	1.918	1.945	1.971	1.997	2.021	2.044
16	0	16.00	0	0	1.125	1.809	1.841	1.871	1.900	1.928	1.955	1.981	2.006	2.031
16	2.5	15.60	1.25	1.25	1.140	1.813	1.844	1.875	1.904	1.932	1.959	1.984	2.009	2.034
16	5	15.20	2.5	2.5	1.156	1.817	1.849	1.879	1.908	1.935	1.962	1.988	2.013	2.037
16	7.5	14.80	3.75	3.75	1.172	1.822	1.853	1.883	1.911	1.939	1.966	1.991	2.016	2.040
16	10	14.40	5	5	1.189	1.826	1.857	1.887	1.916	1.943	1.970	1.995	2.019	2.043
16	12.5	14.00	6.25	6.25	1.206	1.831	1.862	1.891	1.920	1.947	1.973	1.999	2.023	2.047
16	15	13.60	7.5	7.5	1.224	1.836	1.866	1.896	1.924	1.951	1.978	2.003	2.027	2.050
18	0	18.00	0	0	1.142	1.815	1.847	1.877	1.906	1.935	1.961	1.987	2.013	2.037
18	2.5	17.55	1.25	1.25	1.158	1.819	1.851	1.881	1.910	1.938	1.965	1.991	2.016	2.040
18	5	17.10	2.5	2.5	1.174	1.824	1.855	1.885	1.914	1.942	1.968	1.994	2.019	2.043
18	7.5	16.65	3.75	3.75	1.190	1.828	1.859	1.889	1.918	1.946	1.972	1.998	2.022	2.046
18	10	16.20	5	5	1.207	1.833	1.864	1.893	1.922	1.950	1.976	2.001	2.026	2.049
18	12.5	15.75	6.25	6.25	1.224	1.838	1.868	1.898	1.926	1.954	1.980	2.005	2.029	2.053
18	15	15.30	7.5	7.5	1.242	1.842	1.873	1.903	1.931	1.958	1.984	2.009	2.033	2.056
20	0	20.00	0	0	1.161	1.822	1.854	1.884	1.913	1.941	1.968	1.994	2.019	2.043
20	2.5	19.50	1.25	1.25	1.176	1.826	1.858	1.888	1.917	1.945	1.971	1.997	2.022	2.046
20	5	19.00	2.5	2.5	1.192	1.831	1.862	1.892	1.921	1.948	1.975	2.001	2.025	2.049
20	7.5	18.50	3.75	3.75	1.209	1.835	1.866	1.896	1.925	1.952	1.979	2.004	2.029	2.052
20	10	18.00	5	5	1.225	1.840	1.871	1.900	1.929	1.956	1.983	2.008	2.032	2.056
20	12.5	17.50	6.25	6.25	1.243	1.844	1.875	1.905	1.933	1.960	1.987	2.012	2.036	2.059
20	15	17.00	7.5	7.5	1.260	1.849	1.880	1.909	1.938	1.965	1.991	2.016	2.040	2.063
22	0	22.00	0	0	1.180	1.829	1.861	1.891	1.920	1.948	1.975	2.001	2.026	2.050
22	2.5	21.45	1.25	1.25	1.195	1.833	1.865	1.895	1.924	1.952	1.978	2.004	2.029	2.053
22	5	20.90	2.5	2.5	1.211	1.838	1.869	1.899	1.928	1.955	1.982	2.007	2.032	2.056
22	7.5	20.35	3.75	3.75	1.228	1.842	1.873	1.903	1.932	1.959	1.986	2.011	2.036	2.059
22	10	19.80	5	5	1.244	1.847	1.878	1.907	1.936	1.963	1.989	2.015	2.039	2.063
22	12.5	19.25	6.25	6.25	1.262	1.852	1.882	1.912	1.940	1.967	1.993	2.019	2.043	2.066
22	15	18.70	7.5	7.5	1.279	1.857	1.887	1.917	1.945	1.972	1.998	2.023	2.047	2.070
24	0	24.00	0	0	1.199	1.837	1.868	1.898	1.927	1.955	1.982	2.008	2.033	2.057
24	2.5	23.40	1.25	1.25	1.215	1.841	1.872	1.902	1.931	1.959	1.985	2.011	2.036	2.060
24	5	22.80	2.5	2.5	1.231	1.845	1.876	1.906	1.935	1.962	1.989	2.015	2.039	2.063
24	7.5	22.20	3.75	3.75	1.247	1.850	1.881	1.910	1.939	1.966	1.993	2.018	2.043	2.066
24	10	21.60	5	5	1.264	1.854	1.885	1.915	1.943	1.970	1.997	2.022	2.046	2.069
24	12.5	21.00	6.25	6.25	1.281	1.859	1.890	1.919	1.947	1.975	2.001	2.026	2.050	2.073
24	15	20.40	7.5	7.5	1.299	1.864	1.895	1.924	1.952	1.979	2.005	2.030	2.054	2.077
26	0	26.00	0	0	1.220	1.844	1.876	1.906	1.935	1.963	1.989	2.015	2.040	2.064
26	2.5	25.35	1.25	1.25	1.235	1.848	1.880	1.910	1.939	1.966	1.993	2.018	2.043	2.067
26	5	24.70	2.5	2.5	1.251	1.853	1.884	1.914	1.942	1.970	1.996	2.022	2.046	2.070
26	7.5	24.05	3.75	3.75	1.267	1.857	1.888	1.918	1.947	1.974	2.000	2.025	2.050	2.073
26	10	23.40	5	5	1.284	1.862	1.893	1.922	1.951	1.978	2.004	2.029	2.053	2.077
26	12.5	22.75	6.25	6.25	1.301	1.867	1.898	1.927	1.955	1.982	2.008	2.033	2.057	2.080
26	15	22.10	7.5	7.5	1.319	1.872	1.903	1.932	1.960	1.987	2.012	2.037	2.061	2.084
28	0	28.00	0	0	1.240	1.852	1.884	1.914	1.943	1.970	1.997	2.023	2.048	2.071
28	2.5	27.30	1.25	1.25	1.256	1.856	1.888	1.918	1.946	1.974	2.001	2.026	2.051	2.074
28	5	26.60	2.5	2.5	1.272	1.861	1.892	1.922	1.950	1.978	2.004	2.030	2.054	2.078
28	7.5	25.90	3.75	3.75	1.288	1.865	1.896	1.926	1.954	1.982	2.008	2.033	2.057	2.081
28	10	25.20	5	5	1.305	1.870	1.901	1.930	1.959	1.986	2.012	2.037	2.061	2.084
28	12.5	24.50	6.25	6.25	1.322	1.875	1.906	1.935	1.963	1.990	2.016	2.041	2.065	2.088
28	15	23.80	7.5	7.5	1.340	1.880	1.911	1.940	1.968	1.994	2.020	2.045	2.069	2.091
30	0	30.00	0	0	1.262	1.861	1.892	1.922	1.951	1.978	2.005	2.031	2.056	2.079
30	2.5	29.25	1.25	1.25	1.278	1.865	1.896	1.926	1.955	1.982	2.009	2.034	2.059	2.082
30	5	28.50	2.5	2.5	1.294	1.869	1.900	1.930	1.959	1.986	2.012	2.038	2.062	2.085
30	7.5	27.75	3.75	3.75	1.310	1.874	1.905	1.934	1.963	1.990	2.016	2.041	2.065	2.089
30	10	27.00	5	5	1.327	1.879	1.909	1.939	1.967	1.994	2.020	2.045	2.069	2.092
30	12.5	26.25	6.25	6.25	1.344	1.884	1.914	1.943	1.971	1.998	2.024	2.049	2.073	2.096
30	15	25.50	7.5	7.5	1.361	1.889	1.919	1.948	1.976	2.003	2.028	2.053	2.076	2.099
32	0	32.00	0	0	1.285	1.869	1.901	1.931	1.959	1.987	2.014	2.039	2.064	2.088
32	2.5	31.20	1.25	1.25	1.300	1.874	1.905	1.935	1.963	1.991	2.017	2.043	2.067	2.091
32	5	30.40	2.5	2.5	1.316	1.878	1.909	1.939	1.967	1.994	2.021	2.046	2.070	2.094
32	7.5	29.60	3.75	3.75	1.332	1.883	1.913	1.943	1.971	1.998	2.024	2.050	2.074	2.097
32	10	28.80	5	5	1.349	1.888	1.918	1.947	1.976	2.002	2.028	2.053	2.077	2.100
32	12.5	28.00	6.25	6.25	1.366	1.893	1.923	1.952	1.980	2.007	2.032	2.057	2.081	2.104
32	15	27.20	7.5	7.5	1.384	1.898	1.928	1.957	1.985	2.011	2.037	2.061	2.085	2.107
34	0	34.00	0	0	1.308	1.878	1.910	1.940	1.968	1.996	2.022	2.048	2.072	2.096
34	2.5	33.15	1.25	1.25	1.323	1.883	1.914	1.944	1.972	2.000	2.026	2.051	2.076	2.099
34	5	32.30	2.5	2.5	1.339	1.887	1.918	1.948	1.976	2.003	2.030	2.055	2.079	2.102
34	7.5	31.45	3.75	3.75	1.355	1.892	1.923	1.952	1.980	2.007	2.033	2.058	2.082	2.106
34	10	30.60	5	5	1.372	1.897	1.927	1.957	1.985	2.011	2.037	2.062	2.086	2.109
34	12.5	29.75	6.25	6.25	1.389	1.902	1.932	1.961	1.989	2.016	2.041	2.066	2.090	2.112
34	15	28.90	7.5	7.5	1.406	1.907	1.937	1.966	1.994	2.020	2.046	2.070	2.093	2.116
36	0	36.00	0	0	1.332	1.888	1.919	1.949	1.978	2.005	2.032	2.057	2.081	2.105
36	2.5	35.10	1.25	1.25	1.347	1.892	1.923	1.953	1.981	2.009	2.035	2.060	2.085	2.108
36	5	34.20	2.5	2.5	1.363	1.897	1.928	1.957	1.986	2.013	2.039	2.064	2.088	2.111
36	7.5	33.30	3.75	3.75	1.379	1.902	1.932	1.962	1.990	2.017	2.043	2.067	2.091	2.114
36	10	32.40	5	5	1.396	1.906	1.937	1.966	1.994	2.021	2.046	2.071	2.095	2.118
36	12.5	31.50	6.25	6.25	1.413	1.912	1.942	1.971	1.998	2.025	2.051	2.075	2.099	2.121
36	15	30.60	7.5	7.5	1.430	1.917	1.947	1.976	2.003	2.029	2.055	2.079	2.102	2.125
38	0	38.00	0	0	1.357	1.898	1.929	1.959	1.987	2.015	2.041	2.067	2.091	2.114
38	2.5	37.05	1.25	1.25	1.372	1.902	1.933	1.963	1.991	2.019	2.045	2.070	2.094	2.117
38	5	36.10	2.5	2.5	1.388	1.907	1.938	1.967	1.995	2.022	2.048	2.073	2.097	2.121
38	7.5	35.15	3.75	3.75	1.404	1.912	1.942	1.971	2.000	2.026	2.052	2.077	2.101	2.124
38	10	34.20	5	5	1.421	1.917	1.947	1.976	2.004	2.031	2.056	2.081	2.104	2.127
38	12.5	33.25	6.25	6.25	1.437	1.922	1.952	1.981	2.008	2.035	2.060	2.085	2.108	2.131
38	15	32.30	7.5	7.5	1.455	1.927	1.957	1.986	2.013	2.039	2.064	2.089	2.112	2.134
40	0	40.00	0	0	1.383	1.909	1.940	1.969	1.998	2.025	2.051	2.077	2.101	2.124
40	2.5	39.00	1.25	1.25	1.398	1.913	1.944	1.973	2.002	2.029	2.055	2.080	2.104	2.127
40	5	38.00	2.5	2.5	1.414	1.918	1.948	1.978	2.006	2.033	2.059	2.083	2.107	2.130
40	7.5	37.00	3.75	3.75	1.430	1.922	1.953	1.982	2.010	2.037	2.062	2.087	2.111	2.134
40	10	36.00	5	5	1.446	1.927	1.958	1.986	2.014	2.041	2.066	2.091	2.114	2.137
40	12.5	35.00	6.25	6.25	1.463	1.932	1.962	1.991	2.019	2.045	2.070	2.095	2.118	2.140
40	15	34.00	7.5	7.5	1.480	1.938	1.968	1.996	2.023	2.049	2.074	2.099	2.122	2.144

LINEAR REGRESSION OF INPUT SP. GR. vS OUTPUT SP. GR.

For Pozzolan Sp. Gr. of 2.6

Regression Output:

Constant		1.387170
Std Err of Y Est		0.003507
R Squared		0.993939
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.371586	
Std Err of Coef.	0.002410	

For Pozzolan Sp. Gr. of 2.7

Regression Output:

Constant		1.422094
Std Err of Y Est		0.003704
R Squared		0.993129
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.368407	
Std Err of Coef.	0.002545	

For Pozzolan Sp. Gr. of 2.8

Regression Output:

Constant		1.455952
Std Err of Y Est		0.003900
R Squared		0.992246
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.365066	
Std Err of Coef.	0.002680	

For Pozzolan Sp. Gr. of 2.9

Regression Output:

Constant		1.488787
Std Err of Y Est		0.004097
R Squared		0.991289
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.361590	
Std Err of Coef.	0.002815	

For Pozzolan Sp. Gr. of 3.0

Regression Output:

Constant		1.520640
Std Err of Y Est		0.004292
R Squared		0.990257
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.358002	
Std Err of Coef.	0.002949	

For Pozzolan Sp. Gr. of 3.1

Regression Output:

Constant		1.5515509730154
Std Err of Y Est		0.0044851994948411
R Squared		0.98914947661759
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.354322	
Std Err of Coef.	0.003082	

For Pozzolan Sp. Gr. of 3.2

Regression Output:

Constant		1.5815568843756
Std Err of Y Est		0.0046766021012817
R Squared		0.98796419830982
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.350570	
Std Err of Coef.	0.003213	

For Pozzolan Sp. Gr. of 3.3

Regression Output:

Constant		1.6106939902189
Std Err of Y Est		0.0048656862913348
R Squared		0.98670041548777
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.346760	
Std Err of Coef.	0.003343	

For Pozzolan Sp. Gr. of 3.4

Regression Output:

Constant		1.638997
Std Err of Y Est		0.005052
R Squared		0.985357
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.342906	
Std Err of Coef.	0.003471	

POZZOLAN SPECIFIC GRAVITY	X COEFF-ICIENT m	Y INTER-CEPT c
2.6	0.3715862	1.3871699
2.7	0.3684071	1.4220938
2.8	0.3650659	1.4559518
2.9	0.3615895	1.4887870
3.0	0.3580016	1.5206402
3.1	0.3543224	1.5515510
3.2	0.3505700	1.5815569
3.3	0.3467600	1.6106940
3.4	0.3429060	1.6389967

LINEAR REGRESSION OF X COEFFICIENT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant		0.465650
Std Err of Y Est		0.000317
R Squared		0.999096
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	-0.035987	
Std Err of Coef.	0.000409	

LINEAR REGRESSION OF Y INTERCEPT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant		0.573952
Std Err of Y Est		0.003134
R Squared		0.998843
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	0.314514	
Std Err of Coef.	0.004047	

TABLE G-20

207C/CLARIFIER

OUTP DUCT SPECIFIC GRAVITIES FOR DIFFERENT TDS & TSS CONDITIONS FOR A WATER TO POZZOLAN RATI 2
WITH CLARIFIER SILT AS PERCENTAGE OF TOTAL SILT = 60%

SPECIFIC GRAVITY OF POZZOLANS	2.600	2.70	2.80	2.90	3.00	3.10	3.20	3.30	3.40
SPECIFIC GRAVITY OF SALT	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251
SPECIFIC GRAVITY OF SILT	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23
SPECIFIC GRAVITY OF CLAR. SILT	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73
W/P RATIO	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
D(%)	60	60	60	60	60	60	60	60	60

TDS %	TSS %	SALT %	CLAR SILT	SUPE SILT	INPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.
0	0	0.00	0	0	1.000	1.765	1.797	1.827	1.857	1.885	1.912	1.939	1.964	1.988
0	2.5	0.00	1.5	1	1.015	1.769	1.800	1.831	1.860	1.888	1.916	1.942	1.967	1.992
0	5	0.00	3	2	1.031	1.773	1.804	1.835	1.864	1.892	1.919	1.945	1.970	1.995
0	7.5	0.00	4.5	3	1.047	1.777	1.809	1.839	1.868	1.896	1.923	1.949	1.974	1.998
0	10	0.00	6	4	1.064	1.782	1.813	1.843	1.872	1.900	1.927	1.953	1.978	2.002
0	12.5	0.00	7.5	5	1.081	1.786	1.817	1.847	1.876	1.904	1.931	1.957	1.981	2.005
0	15	0.00	9	6	1.099	1.791	1.822	1.852	1.881	1.908	1.935	1.961	1.985	2.009
2	0	2.00	0	0	1.014	1.770	1.801	1.832	1.861	1.890	1.917	1.943	1.969	1.993
2	2.5	1.95	1.5	1	1.029	1.774	1.805	1.836	1.865	1.893	1.920	1.947	1.972	1.996
2	5	1.90	3	2	1.045	1.778	1.809	1.840	1.869	1.897	1.924	1.950	1.975	1.999
2	7.5	1.85	4.5	3	1.061	1.782	1.814	1.844	1.873	1.901	1.928	1.954	1.979	2.003
2	10	1.80	6	4	1.078	1.787	1.818	1.848	1.877	1.905	1.932	1.957	1.982	2.006
2	12.5	1.75	7.5	5	1.096	1.791	1.823	1.852	1.881	1.909	1.936	1.961	1.986	2.010
2	15	1.70	9	6	1.113	1.796	1.827	1.857	1.886	1.913	1.940	1.965	1.990	2.014
4	0	4.00	0	0	1.028	1.775	1.806	1.837	1.866	1.895	1.922	1.948	1.973	1.998
4	2.5	3.90	1.5	1	1.044	1.779	1.810	1.841	1.870	1.898	1.925	1.952	1.977	2.001
4	5	3.80	3	2	1.060	1.783	1.814	1.845	1.874	1.902	1.929	1.955	1.980	2.004
4	7.5	3.70	4.5	3	1.076	1.787	1.819	1.849	1.878	1.906	1.933	1.959	1.984	2.008
4	10	3.60	6	4	1.093	1.792	1.823	1.853	1.882	1.910	1.937	1.962	1.987	2.011
4	12.5	3.50	7.5	5	1.110	1.797	1.828	1.858	1.886	1.914	1.941	1.966	1.991	2.015
4	15	3.40	9	6	1.128	1.801	1.833	1.862	1.891	1.918	1.945	1.970	1.995	2.019
6	0	6.00	0	0	1.043	1.780	1.812	1.842	1.872	1.900	1.927	1.953	1.978	2.003
6	2.5	5.85	1.5	1	1.059	1.784	1.816	1.846	1.875	1.903	1.930	1.957	1.982	2.006
6	5	5.70	3	2	1.075	1.788	1.820	1.850	1.879	1.907	1.934	1.960	1.985	2.009
6	7.5	5.55	4.5	3	1.091	1.793	1.824	1.854	1.883	1.911	1.938	1.964	1.989	2.013
6	10	5.40	6	4	1.108	1.797	1.828	1.858	1.887	1.915	1.942	1.968	1.992	2.016
6	12.5	5.25	7.5	5	1.125	1.802	1.833	1.863	1.892	1.919	1.946	1.972	1.996	2.020
6	15	5.10	9	6	1.143	1.807	1.838	1.868	1.896	1.924	1.950	1.976	2.000	2.024
8	0	8.00	0	0	1.059	1.785	1.817	1.847	1.877	1.905	1.932	1.958	1.984	2.008
8	2.5	7.80	1.5	1	1.074	1.789	1.821	1.851	1.881	1.909	1.936	1.962	1.987	2.011
8	5	7.60	3	2	1.090	1.794	1.825	1.855	1.884	1.912	1.939	1.965	1.990	2.015
8	7.5	7.40	4.5	3	1.107	1.798	1.829	1.860	1.889	1.916	1.943	1.969	1.994	2.018
8	10	7.20	6	4	1.124	1.803	1.834	1.864	1.893	1.921	1.947	1.973	1.998	2.022
8	12.5	7.00	7.5	5	1.141	1.808	1.839	1.869	1.897	1.925	1.951	1.977	2.002	2.025
8	15	6.80	9	6	1.159	1.813	1.844	1.873	1.902	1.929	1.956	1.981	2.006	2.029
10	0	10.00	0	0	1.074	1.791	1.823	1.853	1.882	1.910	1.938	1.964	1.989	2.013
10	2.5	9.75	1.5	1	1.090	1.795	1.827	1.857	1.886	1.914	1.941	1.967	1.992	2.017
10	5	9.50	3	2	1.106	1.799	1.831	1.861	1.890	1.918	1.945	1.971	1.996	2.020
10	7.5	9.25	4.5	3	1.122	1.804	1.835	1.865	1.894	1.922	1.949	1.975	1.999	2.023
10	10	9.00	6	4	1.139	1.808	1.840	1.870	1.898	1.926	1.953	1.978	2.003	2.027
10	12.5	8.75	7.5	5	1.157	1.813	1.844	1.874	1.903	1.930	1.957	1.982	2.007	2.031
10	15	8.50	9	6	1.175	1.818	1.849	1.879	1.908	1.935	1.961	1.987	2.011	2.035
12	0	12.00	0	0	1.091	1.797	1.828	1.859	1.888	1.916	1.943	1.969	1.995	2.019
12	2.5	11.70	1.5	1	1.106	1.801	1.832	1.863	1.892	1.920	1.947	1.973	1.998	2.022
12	5	11.40	3	2	1.122	1.805	1.837	1.867	1.896	1.924	1.951	1.976	2.001	2.025
12	7.5	11.10	4.5	3	1.139	1.810	1.841	1.871	1.900	1.928	1.954	1.980	2.005	2.029
12	10	10.80	6	4	1.156	1.814	1.846	1.876	1.904	1.932	1.959	1.984	2.009	2.033
12	12.5	10.50	7.5	5	1.173	1.819	1.850	1.880	1.909	1.936	1.963	1.988	2.013	2.036
12	15	10.20	9	6	1.192	1.824	1.855	1.885	1.913	1.941	1.967	1.992	2.017	2.040
14	0	14.00	0	0	1.107	1.803	1.834	1.865	1.894	1.922	1.949	1.975	2.000	2.025
14	2.5	13.65	1.5	1	1.123	1.807	1.838	1.869	1.898	1.926	1.953	1.979	2.004	2.028
14	5	13.30	3	2	1.139	1.811	1.843	1.873	1.902	1.930	1.956	1.982	2.007	2.031
14	7.5	12.95	4.5	3	1.156	1.816	1.847	1.877	1.906	1.934	1.960	1.986	2.011	2.035
14	10	12.60	6	4	1.173	1.821	1.852	1.882	1.910	1.938	1.964	1.990	2.015	2.038
14	12.5	12.25	7.5	5	1.190	1.826	1.857	1.886	1.915	1.942	1.969	1.994	2.019	2.042
14	15	11.90	9	6	1.208	1.831	1.862	1.891	1.920	1.947	1.973	1.998	2.023	2.046
16	0	16.00	0	0	1.125	1.809	1.841	1.871	1.900	1.928	1.955	1.981	2.006	2.031
16	2.5	15.60	1.5	1	1.140	1.813	1.845	1.875	1.904	1.932	1.959	1.985	2.010	2.034
16	5	15.20	3	2	1.156	1.818	1.849	1.879	1.908	1.936	1.963	1.988	2.013	2.037
16	7.5	14.80	4.5	3	1.173	1.822	1.853	1.883	1.912	1.940	1.967	1.992	2.017	2.041
16	10	14.40	6	4	1.190	1.827	1.858	1.888	1.917	1.944	1.971	1.996	2.021	2.044
16	12.5	14.00	7.5	5	1.208	1.832	1.863	1.893	1.921	1.949	1.975	2.000	2.025	2.048
16	15	13.60	9	6	1.226	1.837	1.868	1.898	1.926	1.953	1.979	2.005	2.029	2.052
18	0	18.00	0	0	1.142	1.815	1.847	1.877	1.906	1.935	1.961	1.987	2.013	2.037
18	2.5	17.55	1.5	1	1.158	1.820	1.851	1.881	1.910	1.938	1.965	1.991	2.016	2.040
18	5	17.10	3	2	1.174	1.824	1.856	1.886	1.914	1.942	1.969	1.995	2.019	2.043
18	7.5	16.65	4.5	3	1.191	1.829	1.860	1.890	1.919	1.946	1.973	1.999	2.023	2.047
18	10	16.20	6	4	1.208	1.834	1.865	1.895	1.923	1.951	1.977	2.002	2.027	2.051
18	12.5	15.75	7.5	5	1.226	1.839	1.870	1.899	1.928	1.955	1.981	2.007	2.031	2.054
18	15	15.30	9	6	1.244	1.844	1.875	1.904	1.933	1.960	1.986	2.011	2.035	2.058
20	0	20.00	0	0	1.161	1.822	1.854	1.884	1.913	1.941	1.968	1.994	2.019	2.043
20	2.5	19.50	1.5	1	1.177	1.827	1.858	1.888	1.917	1.945	1.972	1.998	2.022	2.046
20	5	19.00	3	2	1.193	1.831	1.862	1.892	1.921	1.949	1.976	2.001	2.026	2.050
20	7.5	18.50	4.5	3	1.209	1.836	1.867	1.897	1.925	1.953	1.980	2.005	2.030	2.053
20	10	18.00	6	4	1.227	1.841	1.872	1.901	1.930	1.957	1.984	2.009	2.034	2.057
20	12.5	17.50	7.5	5	1.244	1.846	1.877	1.906	1.935	1.962	1.988	2.013	2.038	2.061
20	15	17.00	9	6	1.262	1.851	1.882	1.911	1.939	1.966	1.993	2.018	2.042	2.065
22	0	22.00	0	0	1.180	1.829	1.861	1.891	1.920	1.948	1.975	2.001	2.026	2.050
22	2.5	21.45	1.5	1	1.196	1.834	1.865	1.895	1.924	1.952	1.979	2.004	2.029	2.053
22	5	20.90	3	2	1.212	1.838	1.869	1.899	1.928	1.956	1.982	2.008	2.033	2.057
22	7.5	20.35	4.5	3	1.228	1.843	1.874	1.904	1.932	1.960	1.986	2.012	2.036	2.060
22	10	19.80	6	4	1.246	1.848	1.879	1.908	1.937	1.964	1.991	2.016	2.040	2.064
22	12.5	19.25	7.5	5	1.263	1.853	1.884	1.913	1.942	1.969	1.995	2.020	2.044	2.068
22	15	18.70	9	6	1.281	1.858	1.889	1.918	1.946	1.974	1.999	2.024	2.049	2.072
24	0	24.00	0	0	1.199	1.837	1.868	1.898	1.927	1.955	1.982	2.008	2.033	2.057
24	2.5	23.40	1.5	1	1.215	1.841	1.872	1.902	1.931	1.959	1.986	2.011	2.036	2.060
24	5	22.80	3	2	1.231	1.846	1.877	1.907	1.935	1.963	1.990	2.015	2.040	2.063
24	7.5	22.20	4.5	3	1.248	1.850	1.881	1.911	1.940	1.967	1.994	2.019	2.044	2.067
24	10	21.60	6	4	1.265	1.855	1.886	1.916	1.944	1.972	1.998	2.023	2.047	2.071
24	12.5	21.00	7.5	5	1.283	1.861	1.891	1.921	1.949	1.976	2.002	2.027	2.051	2.075
24	15	20.40	9	6	1.301	1.866	1.897	1.926	1.954	1.981	2.007	2.032	2.056	2.079
26	0	26.00	0	0	1.220	1.844	1.876	1.906	1.935	1.963	1.989	2.015	2.040	2.064
26	2.5	25.35	1.5	1	1.235	1.849	1.880	1.910	1.939	1.967	1.993	2.019	2.043	2.067
26	5	24.70	3	2	1.252	1.853	1.884	1.914	1.943	1.971	1.997	2.023	2.047	2.071
26	7.5	24.05	4.5	3	1.268	1.858	1.889	1.919	1.947	1.975	2.001	2.026	2.051	2.074
26	10	23.40	6	4	1.286	1.863	1.894	1.924	1.952	1.979	2.005	2.031	2.055	2.078
26	12.5	22.75	7.5	5	1.303	1.868	1.899	1.928	1.957	1.984	2.010	2.035	2.059	2.082
26	15	22.10	9	6	1.321	1.874	1.904	1.934	1.962	1.988	2.014	2.039	2.063	2.086
28	0	28.00	0	0	1.240	1.852	1.884	1.914	1.943	1.970	1.997	2.023	2.048	2.071
28	2.5	27.30	1.5	1	1.256	1.857	1.888	1.918	1.947	1.974	2.001	2.026	2.051	2.075
28	5	26.60	3	2	1.273	1.861	1.892	1.922	1.951	1.978	2.005	2.030	2.055	2.078
28	7.5	25.90	4.5	3	1.289	1.866	1.897	1.927	1.955	1.983	2.009	2.034	2.058	2.082
28	10	25.20	6	4	1.306	1.871	1.902	1.932	1.960	1.987	2.013	2.038	2.062	2.086
28	12.5	24.50	7.5	5	1.324	1.877	1.907	1.937	1.965	1.992	2.018	2.042	2.066	2.090
28	15	23.80	9	6	1.342	1.882	1.913	1.942	1.970	1.996	2.022	2.047	2.071	2.094
30	0	30.00	0	0	1.262	1.861	1.892	1.922	1.951	1.978	2.005	2.031	2.056	2.079
30	2.5	29.25	1.5	1	1.278	1.865	1.896	1.926	1.955	1.982	2.009	2.034	2.059	2.083
30	5	28.50	3	2	1.294	1.870	1.901	1.931	1.959	1.987	2.013	2.038	2.063	2.086
30	7.5	27.75	4.5	3	1.311	1.875	1.906	1.935	1.964	1.991	2.017	2.042	2.066	2.090
30	10	27.00	6	4	1.328	1.880	1.911	1.940	1.968	1.995	2.021	2.046	2.070	2.094
30	12.5	26.25	7.5	5	1.346	1.885	1.916	1.945	1.973	2.000	2.026	2.051	2.074	2.097
30	15	25.50	9	6	1.364	1.891	1.921	1.950	1.978	2.005	2.030	2.055	2.079	2.101
32	0	32.00	0	0	1.285	1.869	1.901	1.931	1.959	1.987	2.014	2.039	2.064	2.088
32	2.5	31.20	1.5	1	1.300	1.874	1.905	1.935	1.963	1.991	2.017	2.043	2.067	2.091
32	5	30.40	3	2	1.317	1.879	1.910	1.939	1.968	1.995	2.021	2.047	2.071	2.094
32	7.5	29.60	4.5	3	1.333	1.884	1.914	1.944	1.972	1.999	2.025	2.051	2.075	2.098
32	10	28.80	6	4	1.350	1.889	1.919	1.949	1.977	2.004	2.030	2.055	2.079	2.102
32	12.5	28.00	7.5	5	1.368	1.894	1.925	1.954	1.982	2.008	2.034	2.059	2.083	2.106
32	15	27.20	9	6	1.386	1.900	1.930	1.959	1.987	2.013	2.039	2.063	2.087	2.110
34	0	34.00	0	0	1.308	1.878	1.910	1.940	1.968	1.996	2.022	2.048	2.072	2.096
34	2.5	33.15	1.5	1	1.324	1.883	1.914	1.944	1.972	2.000	2.026	2.052	2.076	2.099
34	5	32.30	3	2	1.340	1.888	1.919	1.948	1.977	2.004	2.030	2.055	2.080	2.103
34	7.5	31.45	4.5	3	1.357	1.893	1.924	1.953	1.981	2.008	2.034	2.059	2.083	2.107
34	10	30.60	6	4	1.374	1.898	1.929	1.958	1.986	2.013	2.039	2.063	2.087	2.110
34	12.5	29.75	7.5	5	1.391	1.903	1.934	1.963	1.991	2.017	2.043	2.068	2.091	2.114
34	15	28.90	9	6	1.409	1.909	1.939	1.968	1.996	2.022	2.048	2.072	2.096	2.118
36	0	36.00	0	0	1.332	1.888	1.919	1.949	1.978	2.005	2.032	2.057	2.081	2.105
36	2.5	35.10	1.5	1	1.348	1.893	1.924	1.953	1.982	2.009	2.035	2.061	2.085	2.108
36	5	34.20	3	2	1.364	1.897	1.928	1.958	1.986	2.013	2.039	2.065	2.089	2.112
36	7.5	33.30	4.5	3	1.381	1.903	1.933	1.963	1.991	2.018	2.044	2.069	2.093	2.116
36	10	32.40	6	4	1.397	1.908	1.938	1.967	1.995	2.022	2.048	2.073	2.096	2.119
36	12.5	31.50	7.5	5	1.415	1.913	1.943	1.972	2.000	2.027	2.052	2.077	2.101	2.123
36	15	30.60	9	6	1.433	1.919	1.949	1.978	2.005	2.032	2.057	2.081	2.105	2.127
38	0	38.00	0	0	1.357	1.898	1.929	1.959	1.987	2.015	2.041	2.067	2.091	2.114
38	2.5	37.05	1.5	1	1.373	1.903	1.934	1.963	1.992	2.019	2.045	2.070	2.095	2.118
38	5	36.10	3	2	1.389	1.908	1.938	1.968	1.996	2.023	2.049	2.074	2.098	2.121
38	7.5	35.15	4.5	3	1.405	1.913	1.943	1.973	2.001	2.027	2.053	2.078	2.102	2.125
38	10	34.20	6	4	1.422	1.918	1.948	1.977	2.005	2.032	2.058	2.082	2.106	2.129
38	12.5	33.25	7.5	5	1.440	1.923	1.954	1.982	2.010	2.037	2.062	2.087	2.110	2.133
38	15	32.30	9	6	1.457	1.929	1.959	1.988	2.015	2.041	2.067	2.091	2.114	2.137
40	0	40.00	0	0	1.383	1.909	1.940	1.969	1.998	2.025	2.051	2.077	2.101	2.124
40	2.5	39.00	1.5	1	1.399	1.913	1.944	1.974	2.002	2.029	2.055	2.080	2.104	2.128
40	5	38.00	3	2	1.415	1.918	1.949	1.978	2.006	2.033	2.059	2.084	2.108	2.131
40	7.5	37.00	4.5	3	1.431	1.923	1.954	1.983	2.011	2.038	2.063	2.088	2.112	2.135
40	10	36.00	6	4	1.448	1.929	1.959	1.988	2.016	2.042	2.068	2.092	2.116	2.139
40	12.5	35.00	7.5	5	1.465	1.934	1.964	1.993	2.020	2.047	2.072	2.097	2.120	2.142
40	15	34.00	9	6	1.483	1.940	1.970	1.998	2.026	2.052	2.077	2.101	2.124	2.146

LINEAR REGRESSION OF INPUT SP. GR. vS OUTPUT SP. GR.

For Pozzolan Sp. Gr. of 2.6

Regression Output:

Constant		1.386450
Std Err of Y Est		0.003254
R Squared		0.994834
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.372531	
Std Err of Coef.	0.002229	

For Pozzolan Sp. Gr. of 2.7

Regression Output:

Constant		1.421325
Std Err of Y Est		0.003430
R Squared		0.994169
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.369417	
Std Err of Coef.	0.002350	

For Pozzolan Sp. Gr. of 2.8

Regression Output:

Constant		1.455134
Std Err of Y Est		0.003606
R Squared		0.993443
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.366139	
Std Err of Coef.	0.002470	

For Pozzolan Sp. Gr. of 2.9

Regression Output:

Constant		1.487922
Std Err of Y Est		0.003782
R Squared		0.992655
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.362725	
Std Err of Coef.	0.002591	

For Pozzolan Sp. Gr. of 3.0

Regression Output:

Constant		1.519729
Std Err of Y Est		0.003958
R Squared		0.991805
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.359198	
Std Err of Coef.	0.002711	

For Pozzolan Sp. Gr. of 3.1

Regression Output:

Constant		1.5505941951491
Std Err of Y Est		0.0041324217080622
R Squared		0.99089230249122
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.355578	
Std Err of Coef.	0.002831	

For Pozzolan Sp. Gr. of 3.2

Regression Output:

Constant		1.5805560578539
Std Err of Y Est		0.0043054662861831
R Squared		0.98991484456617
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.351884	
Std Err of Coef.	0.002950	

For Pozzolan Sp. Gr. of 3.3

Regression Output:

Constant		1.6096502107676
Std Err of Y Est		0.0044766769414617
R Squared		0.98887217309003
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.348131	
Std Err of Coef.	0.003067	

For Pozzolan Sp. Gr. of 3.4

Regression Output:

Constant		1.637911
Std Err of Y Est		0.004646
R Squared		0.987763
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.344332	
Std Err of Coef.	0.003183	

POZZOLAN SPECIFIC GRAVITY	X COEFF-ICIENT m	Y INTER-CEPT c
2.6	0.3725308	1.3864504
2.7	0.3694167	1.4213245
2.8	0.3661391	1.4551340
2.9	0.3627250	1.4879217
3.0	0.3591978	1.5197286
3.1	0.3555781	1.5505942
3.2	0.3518838	1.5805561
3.3	0.3481305	1.6096502
3.4	0.3443320	1.6379111

LINEAR REGRESSION OF X COEFFICIENT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant		0.465037
Std Err of Y Est		0.000321
R Squared		0.999038
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	-0.035385	
Std Err of Coef.	0.000415	

LINEAR REGRESSION OF Y INTERCEPT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant		0.574418
Std Err of Y Est		0.003131
R Squared		0.998842
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	0.314056	
Std Err of Coef.	0.004042	

TABLE G 21

207C/CLARIFIER

OUTF[illegible]DUCT SPECIFIC GRAVITIES FOR DIFFERENT TDS & TSS CONDITIONS FOR A WATER TO POZZOLAN RATI[illegible]2

WITH CLARIFIER SILT AS PERCENTAGE OF TOTAL SILT = 70%

SPECIFIC GRAVITY OF POZZOLANS	2.600	2.70	2.80	2.90	3.00	3.10	3.20	3.30	3.40
SPECIFIC GRAVITY OF SALT	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251
SPECIFIC GRAVITY OF SILT	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23
SPECIFIC GRAVITY OF CLAR. SILT	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73
W/P RATIO	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
(%)	70	70	70	70	70	70	70	70	70

TDS %	TSS %	SALT %	CLAR SILT	SILT	INPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.
0	0	0.00	0	0	1.000	1.765	1.797	1.827	1.857	1.885	1.912	1.939	1.964	1.988
0	2.5	0.00	1.75	0.75	1.015	1.769	1.801	1.831	1.860	1.889	1.916	1.942	1.967	1.992
0	5	0.00	3.5	1.5	1.031	1.773	1.805	1.835	1.864	1.893	1.920	1.946	1.971	1.995
0	7.5	0.00	5.25	2.25	1.048	1.778	1.809	1.840	1.869	1.897	1.924	1.950	1.975	1.999
0	10	0.00	7	3	1.065	1.782	1.814	1.844	1.873	1.901	1.928	1.954	1.979	2.003
0	12.5	0.00	8.75	3.75	1.082	1.787	1.819	1.849	1.877	1.905	1.932	1.958	1.983	2.007
0	15	0.00	10.5	4.5	1.101	1.792	1.824	1.853	1.882	1.910	1.936	1.962	1.987	2.011
2	0	2.00	0	0	1.014	1.770	1.801	1.832	1.861	1.890	1.917	1.943	1.969	1.993
2	2.5	1.95	1.75	0.75	1.030	1.774	1.806	1.836	1.865	1.893	1.921	1.947	1.972	1.996
2	5	1.90	3.5	1.5	1.046	1.778	1.810	1.840	1.869	1.897	1.924	1.951	1.976	2.000
2	7.5	1.85	5.25	2.25	1.062	1.783	1.814	1.844	1.874	1.902	1.928	1.954	1.979	2.004
2	10	1.80	7	3	1.079	1.787	1.819	1.849	1.878	1.906	1.933	1.958	1.983	2.007
2	12.5	1.75	8.75	3.75	1.097	1.792	1.824	1.854	1.882	1.910	1.937	1.963	1.987	2.011
2	15	1.70	10.5	4.5	1.115	1.798	1.829	1.859	1.887	1.915	1.941	1.967	1.992	2.015
4	0	4.00	0	0	1.028	1.775	1.806	1.837	1.866	1.895	1.922	1.948	1.973	1.998
4	2.5	3.90	1.75	0.75	1.044	1.779	1.811	1.841	1.870	1.898	1.926	1.952	1.977	2.001
4	5	3.80	3.5	1.5	1.060	1.783	1.815	1.845	1.874	1.902	1.929	1.955	1.981	2.005
4	7.5	3.70	5.25	2.25	1.077	1.788	1.819	1.850	1.879	1.907	1.933	1.959	1.984	2.009
4	10	3.60	7	3	1.094	1.793	1.824	1.854	1.883	1.911	1.938	1.963	1.988	2.012
4	12.5	3.50	8.75	3.75	1.112	1.798	1.829	1.859	1.888	1.915	1.942	1.968	1.992	2.016
4	15	3.40	10.5	4.5	1.130	1.803	1.834	1.864	1.892	1.920	1.947	1.972	1.997	2.020
6	0	6.00	0	0	1.043	1.780	1.812	1.842	1.872	1.900	1.927	1.953	1.978	2.003
6	2.5	5.85	1.75	0.75	1.059	1.784	1.816	1.846	1.875	1.904	1.931	1.957	1.982	2.006
6	5	5.70	3.5	1.5	1.075	1.789	1.820	1.850	1.880	1.908	1.935	1.961	1.986	2.010
6	7.5	5.55	5.25	2.25	1.092	1.793	1.825	1.855	1.884	1.912	1.939	1.965	1.989	2.014
6	10	5.40	7	3	1.109	1.798	1.829	1.859	1.888	1.916	1.943	1.969	1.993	2.017
6	12.5	5.25	8.75	3.75	1.127	1.803	1.834	1.864	1.893	1.921	1.947	1.973	1.998	2.021
6	15	5.10	10.5	4.5	1.145	1.808	1.839	1.869	1.898	1.925	1.952	1.977	2.002	2.026
8	0	8.00	0	0	1.059	1.785	1.817	1.847	1.877	1.905	1.932	1.958	1.984	2.008
8	2.5	7.80	1.75	0.75	1.074	1.790	1.821	1.852	1.881	1.909	1.936	1.962	1.987	2.011
8	5	7.60	3.5	1.5	1.091	1.794	1.826	1.856	1.885	1.913	1.940	1.966	1.991	2.015
8	7.5	7.40	5.25	2.25	1.107	1.799	1.830	1.860	1.889	1.917	1.944	1.970	1.995	2.019
8	10	7.20	7	3	1.125	1.804	1.835	1.865	1.894	1.922	1.948	1.974	1.999	2.023
8	12.5	7.00	8.75	3.75	1.142	1.809	1.840	1.870	1.898	1.926	1.953	1.978	2.003	2.027
8	15	6.80	10.5	4.5	1.161	1.814	1.845	1.875	1.903	1.931	1.957	1.983	2.007	2.031
10	0	10.00	0	0	1.074	1.791	1.823	1.853	1.882	1.910	1.938	1.964	1.989	2.013
10	2.5	9.75	1.75	0.75	1.090	1.795	1.827	1.857	1.886	1.914	1.941	1.967	1.993	2.017
10	5	9.50	3.5	1.5	1.106	1.800	1.831	1.861	1.891	1.918	1.945	1.971	1.996	2.020
10	7.5	9.25	5.25	2.25	1.123	1.804	1.836	1.866	1.895	1.923	1.950	1.975	2.000	2.024
10	10	9.00	7	3	1.141	1.809	1.841	1.871	1.899	1.927	1.954	1.979	2.004	2.028
10	12.5	8.75	8.75	3.75	1.158	1.815	1.846	1.875	1.904	1.932	1.958	1.984	2.008	2.032
10	15	8.50	10.5	4.5	1.177	1.820	1.851	1.881	1.909	1.937	1.963	1.988	2.013	2.036
12	0	12.00	0	0	1.091	1.797	1.828	1.859	1.888	1.916	1.943	1.969	1.995	2.019
12	2.5	11.70	1.75	0.75	1.106	1.801	1.833	1.863	1.892	1.920	1.947	1.973	1.998	2.022
12	5	11.40	3.5	1.5	1.123	1.806	1.837	1.867	1.896	1.924	1.951	1.977	2.002	2.026
12	7.5	11.10	5.25	2.25	1.140	1.810	1.842	1.872	1.901	1.929	1.955	1.981	2.006	2.030
12	10	10.80	7	3	1.157	1.815	1.847	1.877	1.905	1.933	1.960	1.985	2.010	2.034
12	12.5	10.50	8.75	3.75	1.175	1.821	1.852	1.881	1.910	1.938	1.964	1.990	2.014	2.038
12	15	10.20	10.5	4.5	1.193	1.826	1.857	1.887	1.915	1.942	1.969	1.994	2.019	2.042
14	0	14.00	0	0	1.107	1.803	1.834	1.865	1.894	1.922	1.949	1.975	2.000	2.025
14	2.5	13.65	1.75	0.75	1.123	1.807	1.839	1.869	1.898	1.926	1.953	1.979	2.004	2.028
14	5	13.30	3.5	1.5	1.140	1.812	1.843	1.873	1.902	1.930	1.957	1.983	2.008	2.032
14	7.5	12.95	5.25	2.25	1.157	1.817	1.848	1.878	1.907	1.935	1.961	1.987	2.012	2.036
14	10	12.60	7	3	1.174	1.822	1.853	1.883	1.911	1.939	1.966	1.991	2.016	2.040
14	12.5	12.25	8.75	3.75	1.192	1.827	1.858	1.888	1.916	1.944	1.970	1.996	2.020	2.044
14	15	11.90	10.5	4.5	1.210	1.832	1.863	1.893	1.921	1.949	1.975	2.000	2.024	2.048
16	0	16.00	0	0	1.125	1.809	1.841	1.871	1.900	1.928	1.955	1.981	2.006	2.031
16	2.5	15.60	1.75	0.75	1.141	1.813	1.845	1.875	1.904	1.932	1.959	1.985	2.010	2.034
16	5	15.20	3.5	1.5	1.157	1.818	1.849	1.880	1.909	1.936	1.963	1.989	2.014	2.038
16	7.5	14.80	5.25	2.25	1.174	1.823	1.854	1.884	1.913	1.941	1.967	1.993	2.018	2.042
16	10	14.40	7	3	1.191	1.828	1.859	1.889	1.918	1.945	1.972	1.997	2.022	2.046
16	12.5	14.00	8.75	3.75	1.209	1.833	1.864	1.894	1.923	1.950	1.976	2.002	2.026	2.050
16	15	13.60	10.5	4.5	1.228	1.839	1.870	1.899	1.928	1.955	1.981	2.006	2.031	2.054
18	0	18.00	0	0	1.142	1.815	1.847	1.877	1.906	1.935	1.961	1.987	2.013	2.037
18	2.5	17.55	1.75	0.75	1.158	1.820	1.851	1.882	1.911	1.939	1.965	1.991	2.016	2.040
18	5	17.10	3.5	1.5	1.175	1.825	1.856	1.886	1.915	1.943	1.970	1.995	2.020	2.044
18	7.5	16.65	5.25	2.25	1.192	1.830	1.861	1.891	1.920	1.947	1.974	1.999	2.024	2.048
18	10	16.20	7	3	1.209	1.835	1.866	1.896	1.924	1.952	1.978	2.004	2.028	2.052
18	12.5	15.75	8.75	3.75	1.227	1.840	1.871	1.901	1.929	1.957	1.983	2.008	2.033	2.056
18	15	15.30	10.5	4.5	1.246	1.846	1.876	1.906	1.934	1.961	1.988	2.013	2.037	2.060
20	0	20.00	0	0	1.161	1.822	1.854	1.884	1.913	1.941	1.968	1.994	2.019	2.043
20	2.5	19.50	1.75	0.75	1.177	1.827	1.858	1.888	1.917	1.945	1.972	1.998	2.023	2.047
20	5	19.00	3.5	1.5	1.193	1.832	1.863	1.893	1.922	1.949	1.976	2.002	2.027	2.050
20	7.5	18.50	5.25	2.25	1.210	1.837	1.868	1.898	1.926	1.954	1.980	2.006	2.031	2.054
20	10	18.00	7	3	1.228	1.842	1.873	1.902	1.931	1.959	1.985	2.010	2.035	2.058
20	12.5	17.50	8.75	3.75	1.246	1.847	1.878	1.908	1.936	1.963	1.990	2.015	2.039	2.063
20	15	17.00	10.5	4.5	1.264	1.853	1.883	1.913	1.941	1.968	1.994	2.019	2.044	2.067
22	0	22.00	0	0	1.180	1.829	1.861	1.891	1.920	1.948	1.975	2.001	2.026	2.050
22	2.5	21.45	1.75	0.75	1.196	1.834	1.865	1.895	1.924	1.952	1.979	2.005	2.029	2.053
22	5	20.90	3.5	1.5	1.212	1.839	1.870	1.900	1.929	1.956	1.983	2.009	2.033	2.057
22	7.5	20.35	5.25	2.25	1.229	1.844	1.875	1.905	1.933	1.961	1.987	2.013	2.037	2.061
22	10	19.80	7	3	1.247	1.849	1.880	1.910	1.938	1.966	1.992	2.017	2.042	2.065
22	12.5	19.25	8.75	3.75	1.265	1.854	1.885	1.915	1.943	1.970	1.997	2.022	2.046	2.069
22	15	18.70	10.5	4.5	1.283	1.860	1.891	1.920	1.948	1.975	2.001	2.026	2.051	2.074
24	0	24.00	0	0	1.199	1.837	1.868	1.898	1.927	1.955	1.982	2.008	2.033	2.057
24	2.5	23.40	1.75	0.75	1.215	1.841	1.873	1.903	1.932	1.959	1.986	2.012	2.036	2.060
24	5	22.80	3.5	1.5	1.232	1.846	1.877	1.907	1.936	1.964	1.990	2.016	2.040	2.064
24	7.5	22.20	5.25	2.25	1.249	1.851	1.882	1.912	1.941	1.968	1.995	2.020	2.044	2.068
24	10	21.60	7	3	1.267	1.856	1.887	1.917	1.945	1.973	1.999	2.024	2.049	2.072
24	12.5	21.00	8.75	3.75	1.285	1.862	1.893	1.922	1.951	1.978	2.004	2.029	2.053	2.076
24	15	20.40	10.5	4.5	1.303	1.868	1.898	1.928	1.956	1.983	2.009	2.034	2.058	2.081
26	0	26.00	0	0	1.220	1.844	1.876	1.906	1.935	1.963	1.989	2.015	2.040	2.064
26	2.5	25.35	1.75	0.75	1.236	1.849	1.880	1.910	1.939	1.967	1.993	2.019	2.044	2.068
26	5	24.70	3.5	1.5	1.252	1.854	1.885	1.915	1.944	1.971	1.998	2.023	2.048	2.071
26	7.5	24.05	5.25	2.25	1.269	1.859	1.890	1.920	1.948	1.976	2.002	2.027	2.052	2.075
26	10	23.40	7	3	1.287	1.864	1.895	1.925	1.953	1.980	2.007	2.032	2.056	2.079
26	12.5	22.75	8.75	3.75	1.305	1.870	1.901	1.930	1.958	1.985	2.011	2.036	2.061	2.084
26	15	22.10	10.5	4.5	1.323	1.876	1.906	1.935	1.963	1.990	2.016	2.041	2.065	2.088
28	0	28.00	0	0	1.240	1.852	1.884	1.914	1.943	1.970	1.997	2.023	2.048	2.071
28	2.5	27.30	1.75	0.75	1.257	1.857	1.888	1.918	1.947	1.975	2.001	2.027	2.051	2.075
28	5	26.60	3.5	1.5	1.273	1.862	1.893	1.923	1.952	1.979	2.005	2.031	2.055	2.079
28	7.5	25.90	5.25	2.25	1.290	1.867	1.898	1.928	1.956	1.984	2.010	2.035	2.059	2.083
28	10	25.20	7	3	1.308	1.872	1.903	1.933	1.961	1.988	2.014	2.040	2.064	2.087
28	12.5	24.50	8.75	3.75	1.326	1.878	1.909	1.938	1.966	1.993	2.019	2.044	2.068	2.091
28	15	23.80	10.5	4.5	1.344	1.884	1.914	1.944	1.972	1.998	2.024	2.049	2.073	2.096
30	0	30.00	0	0	1.262	1.861	1.892	1.922	1.951	1.978	2.005	2.031	2.056	2.079
30	2.5	29.25	1.75	0.75	1.278	1.865	1.897	1.926	1.955	1.983	2.009	2.035	2.059	2.083
30	5	28.50	3.5	1.5	1.295	1.870	1.901	1.931	1.960	1.987	2.014	2.039	2.063	2.087
30	7.5	27.75	5.25	2.25	1.312	1.876	1.906	1.936	1.965	1.992	2.018	2.043	2.067	2.091
30	10	27.00	7	3	1.330	1.881	1.912	1.941	1.969	1.997	2.023	2.048	2.072	2.095
30	12.5	26.25	8.75	3.75	1.348	1.887	1.917	1.947	1.975	2.002	2.027	2.052	2.076	2.099
30	15	25.50	10.5	4.5	1.366	1.893	1.923	1.952	1.980	2.007	2.032	2.057	2.081	2.104
32	0	32.00	0	0	1.285	1.869	1.901	1.931	1.959	1.987	2.014	2.039	2.064	2.088
32	2.5	31.20	1.75	0.75	1.301	1.874	1.905	1.935	1.964	1.991	2.018	2.043	2.068	2.091
32	5	30.40	3.5	1.5	1.317	1.879	1.910	1.940	1.968	1.996	2.022	2.047	2.072	2.095
32	7.5	29.60	5.25	2.25	1.334	1.884	1.915	1.945	1.973	2.000	2.027	2.052	2.076	2.099
32	10	28.80	7	3	1.352	1.890	1.921	1.950	1.978	2.005	2.031	2.056	2.080	2.103
32	12.5	28.00	8.75	3.75	1.370	1.896	1.926	1.955	1.983	2.010	2.036	2.061	2.085	2.108
32	15	27.20	10.5	4.5	1.388	1.902	1.932	1.961	1.989	2.015	2.041	2.066	2.089	2.112
34	0	34.00	0	0	1.308	1.878	1.910	1.940	1.968	1.996	2.022	2.048	2.072	2.096
34	2.5	33.15	1.75	0.75	1.324	1.883	1.914	1.944	1.973	2.000	2.027	2.052	2.076	2.100
34	5	32.30	3.5	1.5	1.341	1.888	1.919	1.949	1.977	2.005	2.031	2.056	2.080	2.104
34	7.5	31.45	5.25	2.25	1.358	1.894	1.924	1.954	1.982	2.009	2.035	2.060	2.085	2.108
34	10	30.60	7	3	1.375	1.899	1.930	1.959	1.987	2.014	2.040	2.065	2.089	2.112
34	12.5	29.75	8.75	3.75	1.393	1.905	1.935	1.965	1.992	2.019	2.045	2.070	2.093	2.116
34	15	28.90	10.5	4.5	1.411	1.911	1.941	1.970	1.998	2.024	2.050	2.074	2.098	2.121
36	0	36.00	0	0	1.332	1.888	1.919	1.949	1.978	2.005	2.032	2.057	2.081	2.105
36	2.5	35.10	1.75	0.75	1.348	1.893	1.924	1.954	1.982	2.010	2.036	2.061	2.085	2.109
36	5	34.20	3.5	1.5	1.365	1.898	1.929	1.958	1.987	2.014	2.040	2.065	2.089	2.113
36	7.5	33.30	5.25	2.25	1.382	1.903	1.934	1.964	1.992	2.019	2.045	2.070	2.094	2.117
36	10	32.40	7	3	1.399	1.909	1.940	1.969	1.997	2.024	2.049	2.074	2.098	2.121
36	12.5	31.50	8.75	3.75	1.417	1.915	1.945	1.974	2.002	2.029	2.054	2.079	2.102	2.125
36	15	30.60	10.5	4.5	1.435	1.921	1.951	1.980	2.007	2.034	2.059	2.084	2.107	2.130
38	0	38.00	0	0	1.357	1.898	1.929	1.959	1.987	2.015	2.041	2.067	2.091	2.114
38	2.5	37.05	1.75	0.75	1.373	1.903	1.934	1.964	1.992	2.019	2.045	2.071	2.095	2.118
38	5	36.10	3.5	1.5	1.390	1.908	1.939	1.968	1.997	2.024	2.050	2.075	2.099	2.122
38	7.5	35.15	5.25	2.25	1.407	1.914	1.944	1.974	2.002	2.029	2.054	2.079	2.103	2.126
38	10	34.20	7	3	1.424	1.919	1.950	1.979	2.007	2.033	2.059	2.084	2.108	2.130
38	12.5	33.25	8.75	3.75	1.442	1.925	1.955	1.984	2.012	2.038	2.064	2.088	2.112	2.135
38	15	32.30	10.5	4.5	1.460	1.931	1.961	1.990	2.017	2.044	2.069	2.093	2.117	2.139
40	0	40.00	0	0	1.383	1.909	1.940	1.969	1.998	2.025	2.051	2.077	2.101	2.124
40	2.5	39.00	1.75	0.75	1.399	1.914	1.944	1.974	2.002	2.030	2.056	2.081	2.105	2.128
40	5	38.00	3.5	1.5	1.416	1.919	1.950	1.979	2.007	2.034	2.060	2.085	2.109	2.132
40	7.5	37.00	5.25	2.25	1.432	1.924	1.955	1.984	2.012	2.039	2.065	2.089	2.113	2.136
40	10	36.00	7	3	1.450	1.930	1.960	1.989	2.017	2.044	2.069	2.094	2.118	2.140
40	12.5	35.00	8.75	3.75	1.467	1.936	1.966	1.995	2.022	2.049	2.074	2.099	2.122	2.145
40	15	34.00	10.5	4.5	1.485	1.942	1.972	2.000	2.028	2.054	2.079	2.103	2.127	2.149

LINEAR REGRESSION OF INPUT SP. GR. vS OUTPUT SP. GR.

For Pozzolan Sp. Gr. of 2.6

Regression Output:

Constant		1.385707
Std Err of Y Est		0.003006
R Squared		0.995636
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.373494	
Std Err of Coef.	0.002053	

For Pozzolan Sp. Gr. of 2.7

Regression Output:

Constant		1.420529
Std Err of Y Est		0.003160
R Squared		0.995100
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.370446	
Std Err of Coef.	0.002159	

For Pozzolan Sp. Gr. of 2.8

Regression Output:

Constant		1.454289
Std Err of Y Est		0.003316
R Squared		0.994515
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.367233	
Std Err of Coef.	0.002265	

For Pozzolan Sp. Gr. of 2.9

Regression Output:

Constant		1.487027
Std Err of Y Est		0.003472
R Squared		0.993879
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.363883	
Std Err of Coef.	0.002371	

For Pozzolan Sp. Gr. of 3.0

Regression Output:

Constant		1.518786
Std Err of Y Est		0.003628
R Squared		0.993192
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.360418	
Std Err of Coef.	0.002478	

For Pozzolan Sp. Gr. of 3.1

Regression Output:

Constant		1.5496046846018
Std Err of Y Est		0.0037835820297809
R Squared		0.99245318826898
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.356859	
Std Err of Coef.	0.002584	

For Pozzolan Sp. Gr. of 3.2

Regression Output:

Constant		1.5795208462777
Std Err of Y Est		0.0039380719742235
R Squared		0.99166182977166
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.353224	
Std Err of Coef.	0.002690	

For Pozzolan Sp. Gr. of 3.3

Regression Output:

Constant		1.608570424685
Std Err of Y Est		0.0040912307261502
R Squared		0.99081718401877
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.349529	
Std Err of Coef.	0.002794	

For Pozzolan Sp. Gr. of 3.4

Regression Output:

Constant		1.636788
Std Err of Y Est		0.004243
R Squared		0.989918
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.345787	
Std Err of Coef.	0.002898	

POZZOLAN SPECIFIC GRAVITY	X COEFF-ICIENT m	Y INTER-CEPT c
2.6	0.3734938	1.3857070
2.7	0.3704460	1.4205295
2.8	0.3672334	1.4542886
2.9	0.3638829	1.4870270
3.0	0.3604179	1.5187860
3.1	0.3568590	1.5496047
3.2	0.3532241	1.5795208
3.3	0.3495289	1.6085704
3.4	0.3457871	1.6367878

LINEAR REGRESSION OF X COEFFICIENT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant		0.464407
Std Err of Y Est		0.000326
R Squared		0.998976
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	-0.034770	
Std Err of Coef.	0.000421	

LINEAR REGRESSION OF Y INTERCEPT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant		0.574903
Std Err of Y Est		0.003127
R Squared		0.998641
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	0.313581	
Std Err of Coef.	0.004037	

TABLE G-22

207C/CLARIFIER

OUTPUT PRODUCT SPECIFIC GRAVITIES FOR DIFFERENT TDS & TSS CONDITIONS FOR A WATER TO POZZOLAN RATIO OF 0.42

WITH CLARIFIER SILT AS PERCENTAGE OF TOTAL SILT = 80%

SPECIFIC GRAVITY OF POZZOLANS						2.600	2.70	2.80	2.90	3.00	3.10	3.20	3.30	3.40
SPECIFIC GRAVITY OF SALT						3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251
SPECIFIC GRAVITY OF SILT						2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23
SPECIFIC GRAVITY OF CLAR. SILT						2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73
W/P RATIO						0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
[illegible](%)						80	80	80	80	80	80	80	80	80
TDS %	TSS %	SALT %	[illegible]	[illegible]	INPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.
0	0	0.00	0	0	1.000	1.765	1.797	1.827	1.857	1.885	1.912	1.939	1.964	1.988
0	2.5	0.00	2	0.5	1.016	1.769	1.801	1.831	1.861	1.889	1.916	1.942	1.968	1.992
0	5	0.00	4	1	1.032	1.774	1.805	1.836	1.865	1.893	1.920	1.946	1.971	1.996
0	7.5	0.00	6	1.5	1.049	1.778	1.810	1.840	1.869	1.897	1.924	1.950	1.975	2.000
0	10	0.00	8	2	1.066	1.783	1.815	1.845	1.874	1.902	1.929	1.955	1.980	2.004
0	12.5	0.00	10	2.5	1.084	1.788	1.820	1.850	1.879	1.906	1.933	1.959	1.984	2.008
0	15	0.00	12	3	1.102	1.794	1.825	1.855	1.884	1.911	1.938	1.964	1.988	2.012
2	0	2.00	0	0	1.014	1.770	1.801	1.832	1.861	1.890	1.917	1.943	1.969	1.993
2	2.5	1.95	2	0.5	1.030	1.774	1.806	1.836	1.866	1.894	1.921	1.947	1.972	1.997
2	5	1.90	4	1	1.046	1.779	1.810	1.841	1.870	1.898	1.925	1.951	1.976	2.000
2	7.5	1.85	6	1.5	1.063	1.783	1.815	1.845	1.874	1.902	1.929	1.955	1.980	2.004
2	10	1.80	8	2	1.080	1.788	1.820	1.850	1.878	1.907	1.934	1.959	1.984	2.008
2	12.5	1.75	10	2.5	1.098	1.793	1.825	1.855	1.884	1.911	1.938	1.964	1.989	2.013
2	15	1.70	12	3	1.117	1.799	1.830	1.860	1.889	1.916	1.943	1.969	1.993	2.017
4	0	4.00	0	0	1.028	1.775	1.806	1.837	1.866	1.895	1.922	1.948	1.973	1.998
4	2.5	3.90	2	0.5	1.044	1.779	1.811	1.841	1.871	1.899	1.926	1.952	1.977	2.002
4	5	3.80	4	1	1.061	1.784	1.815	1.846	1.875	1.903	1.930	1.956	1.981	2.005
4	7.5	3.70	6	1.5	1.077	1.789	1.820	1.850	1.879	1.907	1.934	1.960	1.985	2.009
4	10	3.60	8	2	1.095	1.794	1.825	1.855	1.884	1.912	1.939	1.964	1.989	2.013
4	12.5	3.50	10	2.5	1.113	1.799	1.830	1.860	1.889	1.917	1.943	1.969	1.994	2.018
4	15	3.40	12	3	1.131	1.804	1.835	1.865	1.894	1.922	1.948	1.974	1.998	2.022
6	0	6.00	0	0	1.043	1.780	1.812	1.842	1.872	1.900	1.927	1.953	1.978	2.003
6	2.5	5.85	2	0.5	1.059	1.784	1.816	1.846	1.876	1.904	1.931	1.957	1.982	2.007
6	5	5.70	4	1	1.076	1.789	1.821	1.851	1.880	1.908	1.935	1.961	1.986	2.010
6	7.5	5.55	6	1.5	1.093	1.794	1.825	1.856	1.885	1.912	1.939	1.965	1.990	2.014
6	10	5.40	8	2	1.110	1.799	1.830	1.860	1.889	1.917	1.944	1.970	1.995	2.019
6	12.5	5.25	10	2.5	1.128	1.804	1.835	1.865	1.894	1.922	1.949	1.974	1.999	2.023
6	15	5.10	12	3	1.147	1.810	1.841	1.871	1.899	1.927	1.953	1.979	2.004	2.027
8	0	8.00	0	0	1.059	1.785	1.817	1.847	1.877	1.905	1.932	1.958	1.984	2.008
8	2.5	7.80	2	0.5	1.075	1.790	1.821	1.852	1.881	1.909	1.936	1.962	1.987	2.012
8	5	7.60	4	1	1.091	1.795	1.826	1.856	1.885	1.913	1.940	1.966	1.991	2.016
8	7.5	7.40	6	1.5	1.108	1.799	1.831	1.861	1.890	1.918	1.945	1.971	1.996	2.020
8	10	7.20	8	2	1.126	1.805	1.836	1.866	1.895	1.923	1.949	1.975	2.000	2.024
8	12.5	7.00	10	2.5	1.144	1.810	1.841	1.871	1.900	1.927	1.954	1.980	2.004	2.028
8	15	6.80	12	3	1.162	1.815	1.846	1.876	1.905	1.932	1.959	1.984	2.009	2.033
10	0	10.00	0	0	1.074	1.791	1.823	1.853	1.882	1.910	1.938	1.964	1.989	2.013
10	2.5	9.75	2	0.5	1.090	1.795	1.827	1.857	1.887	1.915	1.942	1.968	1.993	2.017
10	5	9.50	4	1	1.107	1.800	1.832	1.862	1.891	1.919	1.946	1.972	1.997	2.021
10	7.5	9.25	6	1.5	1.124	1.805	1.837	1.867	1.896	1.924	1.950	1.976	2.001	2.025
10	10	9.00	8	2	1.142	1.810	1.842	1.872	1.900	1.928	1.955	1.981	2.005	2.029
10	12.5	8.75	10	2.5	1.160	1.816	1.847	1.877	1.905	1.933	1.960	1.985	2.010	2.034
10	15	8.50	12	3	1.178	1.821	1.852	1.882	1.911	1.938	1.965	1.990	2.015	2.038
12	0	12.00	0	0	1.091	1.797	1.828	1.859	1.888	1.916	1.943	1.969	1.995	2.019
12	2.5	11.70	2	0.5	1.107	1.801	1.833	1.863	1.892	1.920	1.947	1.973	1.998	2.023
12	5	11.40	4	1	1.123	1.806	1.838	1.868	1.897	1.925	1.952	1.978	2.002	2.027
12	7.5	11.10	6	1.5	1.140	1.811	1.842	1.873	1.901	1.929	1.956	1.982	2.007	2.031
12	10	10.80	8	2	1.158	1.816	1.848	1.878	1.906	1.934	1.961	1.986	2.011	2.035
12	12.5	10.50	10	2.5	1.176	1.822	1.853	1.883	1.911	1.939	1.965	1.991	2.016	2.039
12	15	10.20	12	3	1.195	1.827	1.858	1.888	1.917	1.944	1.971	1.996	2.020	2.044
14	0	14.00	0	0	1.107	1.803	1.834	1.865	1.894	1.922	1.949	1.975	2.000	2.025
14	2.5	13.65	2	0.5	1.124	1.807	1.839	1.869	1.898	1.926	1.953	1.979	2.004	2.028
14	5	13.30	4	1	1.140	1.812	1.844	1.874	1.903	1.931	1.958	1.983	2.008	2.032
14	7.5	12.95	6	1.5	1.157	1.817	1.849	1.879	1.908	1.935	1.962	1.988	2.013	2.036
14	10	12.60	8	2	1.175	1.823	1.854	1.884	1.912	1.940	1.967	1.992	2.017	2.041
14	12.5	12.25	10	2.5	1.193	1.828	1.859	1.889	1.918	1.945	1.972	1.997	2.022	2.045
14	15	11.90	12	3	1.212	1.834	1.865	1.894	1.923	1.950	1.977	2.002	2.026	2.050
16	0	16.00	0	0	1.125	1.809	1.841	1.871	1.900	1.928	1.955	1.981	2.006	2.031
16	2.5	15.60	2	0.5	1.141	1.814	1.845	1.875	1.904	1.932	1.959	1.985	2.010	2.034
16	5	15.20	4	1	1.158	1.819	1.850	1.880	1.909	1.937	1.964	1.990	2.014	2.038
16	7.5	14.80	6	1.5	1.175	1.824	1.855	1.885	1.914	1.942	1.968	1.994	2.019	2.043
16	10	14.40	8	2	1.193	1.829	1.860	1.890	1.919	1.946	1.973	1.998	2.023	2.047
16	12.5	14.00	10	2.5	1.211	1.835	1.866	1.895	1.924	1.951	1.978	2.003	2.028	2.051
16	15	13.60	12	3	1.230	1.840	1.871	1.901	1.929	1.957	1.983	2.008	2.033	2.056
18	0	18.00	0	0	1.142	1.815	1.847	1.877	1.906	1.935	1.961	1.987	2.013	2.037
18	2.5	17.55	2	0.5	1.159	1.820	1.852	1.882	1.911	1.939	1.966	1.992	2.017	2.041
18	5	17.10	4	1	1.175	1.825	1.857	1.887	1.916	1.943	1.970	1.996	2.021	2.045
18	7.5	16.65	6	1.5	1.193	1.830	1.862	1.892	1.920	1.948	1.975	2.000	2.025	2.049
18	10	16.20	8	2	1.211	1.836	1.867	1.897	1.925	1.953	1.979	2.005	2.029	2.053
18	12.5	15.75	10	2.5	1.229	1.841	1.872	1.902	1.931	1.958	1.984	2.010	2.034	2.058
18	15	15.30	12	3	1.248	1.847	1.878	1.908	1.936	1.963	1.989	2.015	2.039	2.062
20	0	20.00	0	0	1.161	1.822	1.854	1.884	1.913	1.941	1.968	1.994	2.019	2.043
20	2.5	19.50	2	0.5	1.177	1.827	1.858	1.889	1.918	1.945	1.972	1.998	2.023	2.047
20	5	19.00	4	1	1.194	1.832	1.863	1.893	1.922	1.950	1.977	2.002	2.027	2.051
20	7.5	18.50	6	1.5	1.211	1.837	1.868	1.898	1.927	1.955	1.981	2.007	2.032	2.055
20	10	18.00	8	2	1.229	1.843	1.874	1.904	1.932	1.960	1.986	2.012	2.036	2.060
20	12.5	17.50	10	2.5	1.247	1.848	1.879	1.909	1.937	1.965	1.991	2.016	2.041	2.064
20	15	17.00	12	3	1.266	1.854	1.885	1.915	1.943	1.970	1.996	2.021	2.046	2.069
22	0	22.00	0	0	1.180	1.829	1.861	1.891	1.920	1.948	1.975	2.001	2.026	2.050
22	2.5	21.45	2	0.5	1.196	1.834	1.865	1.896	1.925	1.952	1.979	2.005	2.030	2.054
22	5	20.90	4	1	1.213	1.839	1.870	1.900	1.929	1.957	1.984	2.009	2.034	2.058
22	7.5	20.35	6	1.5	1.230	1.844	1.876	1.906	1.934	1.962	1.988	2.014	2.038	2.062
22	10	19.80	8	2	1.248	1.850	1.881	1.911	1.939	1.967	1.993	2.018	2.043	2.066
22	12.5	19.25	10	2.5	1.267	1.856	1.887	1.916	1.945	1.972	1.998	2.023	2.048	2.071
22	15	18.70	12	3	1.285	1.862	1.892	1.922	1.950	1.977	2.003	2.028	2.053	2.076
24	0	24.00	0	0	1.199	1.837	1.868	1.898	1.927	1.955	1.982	2.008	2.033	2.057
24	2.5	23.40	2	0.5	1.216	1.841	1.873	1.903	1.932	1.960	1.986	2.012	2.037	2.061
24	5	22.80	4	1	1.233	1.847	1.878	1.908	1.937	1.964	1.991	2.016	2.041	2.065
24	7.5	22.20	6	1.5	1.250	1.852	1.883	1.913	1.942	1.969	1.995	2.021	2.045	2.069
24	10	21.60	8	2	1.268	1.858	1.888	1.918	1.947	1.974	2.000	2.026	2.050	2.073
24	12.5	21.00	10	2.5	1.286	1.863	1.894	1.924	1.952	1.979	2.005	2.031	2.055	2.078
24	15	20.40	12	3	1.305	1.869	1.900	1.929	1.958	1.985	2.011	2.036	2.060	2.083
26	0	26.00	0	0	1.220	1.844	1.876	1.906	1.935	1.963	1.989	2.015	2.040	2.064
26	2.5	25.35	2	0.5	1.236	1.849	1.880	1.911	1.939	1.967	1.994	2.019	2.044	2.068
26	5	24.70	4	1	1.253	1.854	1.886	1.915	1.944	1.972	1.998	2.024	2.048	2.072
26	7.5	24.05	6	1.5	1.270	1.860	1.891	1.921	1.949	1.977	2.003	2.028	2.053	2.076
26	10	23.40	8	2	1.288	1.865	1.896	1.926	1.954	1.982	2.008	2.033	2.057	2.081
26	12.5	22.75	10	2.5	1.307	1.871	1.902	1.931	1.960	1.987	2.013	2.038	2.062	2.085
26	15	22.10	12	3	1.326	1.877	1.908	1.937	1.965	1.992	2.018	2.043	2.067	2.090
28	0	28.00	0	0	1.240	1.852	1.884	1.914	1.943	1.970	1.997	2.023	2.048	2.071
28	2.5	27.30	2	0.5	1.257	1.857	1.888	1.918	1.947	1.975	2.002	2.027	2.052	2.075
28	5	26.60	4	1	1.274	1.862	1.894	1.923	1.952	1.980	2.006	2.032	2.056	2.080
28	7.5	25.90	6	1.5	1.291	1.868	1.899	1.929	1.957	1.985	2.011	2.036	2.061	2.084
28	10	25.20	8	2	1.309	1.874	1.904	1.934	1.962	1.990	2.016	2.041	2.065	2.088
28	12.5	24.50	10	2.5	1.328	1.880	1.910	1.940	1.968	1.995	2.021	2.046	2.070	2.093
28	15	23.80	12	3	1.347	1.886	1.916	1.945	1.973	2.000	2.026	2.051	2.075	2.098
30	0	30.00	0	0	1.262	1.861	1.892	1.922	1.951	1.978	2.005	2.031	2.056	2.079
30	2.5	29.25	2	0.5	1.279	1.866	1.897	1.927	1.955	1.983	2.010	2.035	2.060	2.083
30	5	28.50	4	1	1.296	1.871	1.902	1.932	1.960	1.988	2.014	2.040	2.064	2.088
30	7.5	27.75	6	1.5	1.313	1.876	1.907	1.937	1.965	1.993	2.019	2.044	2.069	2.092
30	10	27.00	8	2	1.331	1.882	1.913	1.942	1.971	1.998	2.024	2.049	2.073	2.096
30	12.5	26.25	10	2.5	1.349	1.888	1.919	1.948	1.976	2.003	2.029	2.054	2.078	2.101
30	15	25.50	12	3	1.368	1.894	1.925	1.954	1.982	2.009	2.035	2.059	2.083	2.106
32	0	32.00	0	0	1.285	1.869	1.901	1.931	1.959	1.987	2.014	2.039	2.064	2.088
32	2.5	31.20	2	0.5	1.301	1.874	1.906	1.935	1.964	1.992	2.018	2.043	2.068	2.092
32	5	30.40	4	1	1.318	1.880	1.911	1.940	1.969	1.996	2.023	2.048	2.072	2.096
32	7.5	29.60	6	1.5	1.336	1.885	1.916	1.946	1.974	2.001	2.028	2.053	2.077	2.100
32	10	28.80	8	2	1.353	1.891	1.922	1.951	1.979	2.007	2.033	2.058	2.082	2.105
32	12.5	28.00	10	2.5	1.372	1.897	1.928	1.957	1.985	2.012	2.038	2.063	2.086	2.109
32	15	27.20	12	3	1.391	1.903	1.934	1.963	1.991	2.017	2.043	2.068	2.092	2.114
34	0	34.00	0	0	1.308	1.878	1.910	1.940	1.968	1.996	2.022	2.048	2.072	2.096
34	2.5	33.15	2	0.5	1.324	1.884	1.915	1.944	1.973	2.001	2.027	2.052	2.077	2.100
34	5	32.30	4	1	1.341	1.889	1.920	1.950	1.978	2.005	2.032	2.057	2.081	2.104
34	7.5	31.45	6	1.5	1.359	1.895	1.925	1.955	1.983	2.010	2.036	2.062	2.086	2.109
34	10	30.60	8	2	1.377	1.900	1.931	1.960	1.989	2.016	2.041	2.066	2.090	2.113
34	12.5	29.75	10	2.5	1.395	1.907	1.937	1.966	1.994	2.021	2.047	2.071	2.095	2.118
34	15	28.90	12	3	1.414	1.913	1.943	1.972	2.000	2.027	2.052	2.077	2.100	2.123
36	0	36.00	0	0	1.332	1.888	1.919	1.949	1.978	2.005	2.032	2.057	2.081	2.105
36	2.5	35.10	2	0.5	1.349	1.893	1.924	1.954	1.982	2.010	2.036	2.061	2.086	2.109
36	5	34.20	4	1	1.365	1.899	1.930	1.959	1.987	2.015	2.041	2.066	2.090	2.113
36	7.5	33.30	6	1.5	1.383	1.904	1.935	1.964	1.993	2.020	2.046	2.071	2.095	2.118
36	10	32.40	8	2	1.401	1.910	1.941	1.970	1.998	2.025	2.051	2.076	2.100	2.122
36	12.5	31.50	10	2.5	1.419	1.916	1.947	1.976	2.004	2.030	2.056	2.081	2.104	2.127
36	15	30.60	12	3	1.438	1.923	1.953	1.982	2.010	2.036	2.062	2.086	2.110	2.132
38	0	38.00	0	0	1.357	1.898	1.929	1.959	1.987	2.015	2.041	2.067	2.091	2.114
38	2.5	37.05	2	0.5	1.374	1.903	1.934	1.964	1.992	2.020	2.046	2.071	2.095	2.119
38	5	36.10	4	1	1.390	1.909	1.940	1.969	1.997	2.025	2.051	2.076	2.100	2.123
38	7.5	35.15	6	1.5	1.408	1.915	1.945	1.975	2.003	2.030	2.056	2.080	2.104	2.127
38	10	34.20	8	2	1.426	1.921	1.951	1.980	2.008	2.035	2.061	2.085	2.109	2.132
38	12.5	33.25	10	2.5	1.444	1.927	1.957	1.986	2.014	2.040	2.066	2.090	2.114	2.137
38	15	32.30	12	3	1.462	1.933	1.963	1.992	2.020	2.046	2.071	2.096	2.119	2.142
40	0	40.00	0	0	1.383	1.909	1.940	1.969	1.998	2.025	2.051	2.077	2.101	2.124
40	2.5	39.00	2	0.5	1.400	1.914	1.945	1.974	2.003	2.030	2.056	2.081	2.105	2.129
40	5	38.00	4	1	1.416	1.919	1.950	1.980	2.008	2.035	2.061	2.086	2.110	2.133
40	7.5	37.00	6	1.5	1.434	1.925	1.956	1.985	2.013	2.040	2.066	2.091	2.114	2.137
40	10	36.00	8	2	1.451	1.931	1.962	1.991	2.019	2.045	2.071	2.095	2.119	2.142
40	12.5	35.00	10	2.5	1.470	1.938	1.968	1.997	2.024	2.051	2.076	2.101	2.124	2.147
40	15	34.00	12	3	1.488	1.944	1.974	2.003	2.030	2.056	2.082	2.106	2.129	2.152

LINEAR REGRESSION OF INPUT SP. GR. vS OUTPUT SP. GR.

For Pozzolan Sp. Gr. of 2.6

Regression Output:

Constant	1.384940
Std Err of Y Est	0.002765
R Squared	0.996348
No. of Observations	147
Degrees of Freedom	145
X Coefficient(s)	0.374475
Std Err of Coef.	0.001883

For Pozzolan Sp. Gr. of 2.7

Regression Output:

Constant	1.419709
Std Err of Y Est	0.002897
R Squared	0.995927
No. of Observations	147
Degrees of Freedom	145
X Coefficient(s)	0.371495
Std Err of Coef.	0.001973

For Pozzolan Sp. Gr. of 2.8

Regression Output:

Constant	1.453416
Std Err of Y Est	0.003032
R Squared	0.995466
No. of Observations	147
Degrees of Freedom	145
X Coefficient(s)	0.368348
Std Err of Coef.	0.002064

For Pozzolan Sp. Gr. of 2.9

Regression Output:

Constant	1.486104
Std Err of Y Est	0.003167
R Squared	0.994964
No. of Observations	147
Degrees of Freedom	145
X Coefficient(s)	0.365063
Std Err of Coef.	0.002157

For Pozzolan Sp. Gr. of 3.0

Regression Output:

Constant	1.517813
Std Err of Y Est	0.003303
R Squared	0.994422
No. of Observations	147
Degrees of Freedom	145
X Coefficient(s)	0.361661
Std Err of Coef.	0.002249

For Pozzolan Sp. Gr. of 3.1

Regression Output:

Constant	1.548583010602
Std Err of Y Est	0.0034395126510496
R Squared	0.9938374654595
No. of Observations	147
Degrees of Freedom	145
X Coefficient(s)	0.358165
Std Err of Coef.	0.002342

For Pozzolan Sp. Gr. of 3.2

Regression Output:

Constant	1.5784518408162
Std Err of Y Est	0.0035751967125959
R Squared	0.99321104329527
No. of Observations	147
Degrees of Freedom	145
X Coefficient(s)	0.354590
Std Err of Coef.	0.002435

For Pozzolan Sp. Gr. of 3.3

Regression Output:

Constant	1.6074552445309
Std Err of Y Est	0.0037100731263576
R Squared	0.99254190714253
No. of Observations	147
Degrees of Freedom	145
X Coefficient(s)	0.350954
Std Err of Coef.	0.002528

For Pozzolan Sp. Gr. of 3.4

Regression Output:

Constant	1.635628
Std Err of Y Est	0.003844
R Squared	0.991829
No. of Observations	147
Degrees of Freedom	145
X Coefficient(s)	0.347271
Std Err of Coef.	0.002618

POZZOLAN SPECIFIC GRAVITY	X COEFF-ICIENT m	Y INTER-CEPT c
2.6	0.3744745	1.3849400
2.7	0.3714947	1.4197091
2.8	0.3683485	1.4534160
2.9	0.3650629	1.4861036
3.0	0.3616614	1.5178128
3.1	0.3581646	1.5485830
3.2	0.3545904	1.5784518
3.3	0.3509545	1.6074552
3.4	0.3472706	1.6356276

LINEAR REGRESSION OF X COEFFICIENT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant	0.463761
Std Err of Y Est	0.000331
R Squared	0.998907
No. of Observations	9
Degrees of Freedom	7
X Coefficient(s)	-0.034142
Std Err of Coef.	0.000427

LINEAR REGRESSION OF Y INTERCEPT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant	0.575408
Std Err of Y Est	0.003123
R Squared	0.998841
No. of Observations	9
Degrees of Freedom	7
X Coefficient(s)	0.313090
Std Err of Coef.	0.004032

TABLE G-23

207C/CLARIFIER

OUTP[...]DUCT SPECIFIC GRAVITIES FOR DIFFERENT TDS & TSS CONDITIONS FOR A WATER TO POZZOLAN RATIO[...]2

WITH CLARIFIER SILT AS PERCENTAGE OF TOTAL SILT – 90%

SPECIFIC GRAVITY OF POZZOLANS	2.600	2.70	2.80	2.90	3.00	3.10	3.20	3.30	3.40
SPECIFIC GRAVITY OF SALT	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251
SPECIFIC GRAVITY OF SILT	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23
SPECIFIC GRAVITY OF CLAR. SILT	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73
W/P RATIO	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
D(%)	90	90	90	90	90	90	90	90	90

TDS %	TSS %	SALT %	CLAR SILT%	SUPE SILT%	INPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.
0	0	0.00	0	0	1.000	1.765	1.797	1.827	1.857	1.885	1.912	1.939	1.964	1.988
0	2.5	0.00	2.25	0.25	1.016	1.769	1.801	1.832	1.861	1.889	1.916	1.943	1.968	1.992
0	5	0.00	4.5	0.5	1.032	1.774	1.806	1.836	1.865	1.893	1.921	1.947	1.972	1.996
0	7.5	0.00	6.75	0.75	1.049	1.779	1.810	1.841	1.870	1.898	1.925	1.951	1.976	2.000
0	10	0.00	9	1	1.067	1.784	1.816	1.846	1.875	1.903	1.930	1.956	1.981	2.005
0	12.5	0.00	11.25	1.25	1.085	1.789	1.821	1.851	1.880	1.908	1.935	1.960	1.985	2.009
0	15	0.00	13.5	1.5	1.104	1.795	1.826	1.856	1.885	1.913	1.940	1.965	1.990	2.014
2	0	2.00	0	0	1.014	1.770	1.801	1.832	1.861	1.890	1.917	1.943	1.969	1.993
2	2.5	1.95	2.25	0.25	1.030	1.774	1.806	1.836	1.866	1.894	1.921	1.947	1.973	1.997
2	5	1.90	4.5	0.5	1.046	1.779	1.811	1.841	1.870	1.898	1.925	1.952	1.977	2.001
2	7.5	1.85	6.75	0.75	1.064	1.784	1.815	1.846	1.875	1.903	1.930	1.956	1.981	2.005
2	10	1.80	9	1	1.081	1.789	1.821	1.851	1.880	1.908	1.935	1.960	1.985	2.010
2	12.5	1.75	11.25	1.25	1.099	1.795	1.826	1.856	1.885	1.913	1.939	1.965	1.990	2.014
2	15	1.70	13.5	1.5	1.118	1.800	1.831	1.861	1.890	1.918	1.945	1.970	1.995	2.019
4	0	4.00	0	0	1.028	1.775	1.806	1.837	1.866	1.895	1.922	1.948	1.973	1.998
4	2.5	3.90	2.25	0.25	1.045	1.779	1.811	1.841	1.871	1.899	1.926	1.952	1.977	2.002
4	5	3.80	4.5	0.5	1.061	1.784	1.816	1.846	1.875	1.903	1.930	1.956	1.982	2.006
4	7.5	3.70	6.75	0.75	1.078	1.789	1.821	1.851	1.880	1.908	1.935	1.961	1.986	2.010
4	10	3.60	9	1	1.096	1.794	1.826	1.856	1.885	1.913	1.940	1.966	1.990	2.015
4	12.5	3.50	11.25	1.25	1.114	1.800	1.831	1.861	1.890	1.918	1.945	1.970	1.995	2.019
4	15	3.40	13.5	1.5	1.133	1.806	1.837	1.867	1.895	1.923	1.950	1.975	2.000	2.024
6	0	6.00	0	0	1.043	1.780	1.812	1.842	1.872	1.900	1.927	1.953	1.978	2.003
6	2.5	5.85	2.25	0.25	1.059	1.785	1.816	1.847	1.876	1.904	1.931	1.957	1.983	2.007
6	5	5.70	4.5	0.5	1.076	1.789	1.821	1.851	1.880	1.909	1.936	1.962	1.987	2.011
6	7.5	5.55	6.75	0.75	1.093	1.795	1.826	1.856	1.885	1.913	1.940	1.966	1.991	2.015
6	10	5.40	9	1	1.111	1.800	1.831	1.861	1.890	1.918	1.945	1.971	1.996	2.020
6	12.5	5.25	11.25	1.25	1.129	1.805	1.837	1.867	1.895	1.923	1.950	1.976	2.000	2.024
6	15	5.10	13.5	1.5	1.148	1.811	1.842	1.872	1.901	1.929	1.955	1.981	2.005	2.029
8	0	8.00	0	0	1.059	1.785	1.817	1.847	1.877	1.905	1.932	1.958	1.984	2.008
8	2.5	7.80	2.25	0.25	1.075	1.790	1.822	1.852	1.881	1.909	1.936	1.963	1.988	2.012
8	5	7.60	4.5	0.5	1.092	1.795	1.826	1.857	1.886	1.914	1.941	1.967	1.992	2.016
8	7.5	7.40	6.75	0.75	1.109	1.800	1.832	1.862	1.891	1.919	1.946	1.971	1.996	2.020
8	10	7.20	9	1	1.127	1.805	1.837	1.867	1.896	1.924	1.950	1.976	2.001	2.025
8	12.5	7.00	11.25	1.25	1.145	1.811	1.842	1.872	1.901	1.929	1.955	1.981	2.006	2.030
8	15	6.80	13.5	1.5	1.164	1.817	1.848	1.878	1.907	1.934	1.961	1.986	2.011	2.034
10	0	10.00	0	0	1.074	1.791	1.823	1.853	1.882	1.910	1.938	1.964	1.989	2.013
10	2.5	9.75	2.25	0.25	1.091	1.796	1.827	1.858	1.887	1.915	1.942	1.968	1.993	2.017
10	5	9.50	4.5	0.5	1.107	1.801	1.832	1.862	1.892	1.919	1.946	1.972	1.997	2.022
10	7.5	9.25	6.75	0.75	1.125	1.806	1.837	1.867	1.896	1.924	1.951	1.977	2.002	2.026
10	10	9.00	9	1	1.143	1.811	1.843	1.873	1.901	1.929	1.956	1.982	2.006	2.030
10	12.5	8.75	11.25	1.25	1.161	1.817	1.848	1.878	1.907	1.934	1.961	1.987	2.011	2.035
10	15	8.50	13.5	1.5	1.180	1.823	1.854	1.884	1.912	1.940	1.966	1.992	2.016	2.040
12	0	12.00	0	0	1.091	1.797	1.828	1.859	1.888	1.916	1.943	1.969	1.995	2.019
12	2.5	11.70	2.25	0.25	1.107	1.802	1.833	1.863	1.893	1.921	1.948	1.974	1.999	2.023
12	5	11.40	4.5	0.5	1.124	1.807	1.838	1.868	1.897	1.925	1.952	1.978	2.003	2.027
12	7.5	11.10	6.75	0.75	1.141	1.812	1.843	1.873	1.902	1.930	1.957	1.983	2.008	2.032
12	10	10.80	9	1	1.159	1.817	1.849	1.879	1.907	1.935	1.962	1.987	2.012	2.036
12	12.5	10.50	11.25	1.25	1.178	1.823	1.854	1.884	1.913	1.940	1.967	1.992	2.017	2.041
12	15	10.20	13.5	1.5	1.197	1.829	1.860	1.890	1.918	1.946	1.972	1.998	2.022	2.046
14	0	14.00	0	0	1.107	1.803	1.834	1.865	1.894	1.922	1.949	1.975	2.000	2.025
14	2.5	13.65	2.25	0.25	1.124	1.808	1.839	1.869	1.899	1.927	1.954	1.979	2.005	2.029
14	5	13.30	4.5	0.5	1.141	1.813	1.844	1.874	1.903	1.931	1.958	1.984	2.009	2.033
14	7.5	12.95	6.75	0.75	1.158	1.818	1.849	1.879	1.908	1.936	1.963	1.989	2.013	2.037
14	10	12.60	9	1	1.176	1.824	1.855	1.885	1.914	1.941	1.968	1.993	2.018	2.042
14	12.5	12.25	11.25	1.25	1.195	1.829	1.860	1.890	1.919	1.946	1.973	1.998	2.023	2.047
14	15	11.90	13.5	1.5	1.214	1.835	1.866	1.896	1.925	1.952	1.978	2.004	2.028	2.052
16	0	16.00	0	0	1.125	1.809	1.841	1.871	1.900	1.928	1.955	1.981	2.006	2.031
16	2.5	15.60	2.25	0.25	1.141	1.814	1.845	1.876	1.905	1.933	1.960	1.986	2.011	2.035
16	5	15.20	4.5	0.5	1.158	1.819	1.850	1.881	1.910	1.937	1.964	1.990	2.015	2.039
16	7.5	14.80	6.75	0.75	1.176	1.824	1.856	1.886	1.915	1.942	1.969	1.995	2.020	2.043
16	10	14.40	9	1	1.194	1.830	1.861	1.891	1.920	1.947	1.974	2.000	2.024	2.048
16	12.5	14.00	11.25	1.25	1.212	1.836	1.867	1.897	1.925	1.953	1.979	2.005	2.029	2.053
16	15	13.60	13.5	1.5	1.232	1.842	1.873	1.903	1.931	1.958	1.985	2.010	2.034	2.058
18	0	18.00	0	0	1.142	1.815	1.847	1.877	1.906	1.935	1.961	1.987	2.013	2.037
18	2.5	17.55	2.25	0.25	1.159	1.820	1.852	1.882	1.911	1.939	1.966	1.992	2.017	2.041
18	5	17.10	4.5	0.5	1.176	1.826	1.857	1.887	1.916	1.944	1.971	1.996	2.021	2.045
18	7.5	16.65	6.75	0.75	1.194	1.831	1.862	1.892	1.921	1.949	1.976	2.001	2.026	2.050
18	10	16.20	9	1	1.212	1.837	1.868	1.898	1.926	1.954	1.981	2.006	2.031	2.054
18	12.5	15.75	11.25	1.25	1.230	1.843	1.874	1.903	1.932	1.959	1.986	2.011	2.036	2.059
18	15	15.30	13.5	1.5	1.250	1.849	1.880	1.909	1.938	1.965	1.991	2.017	2.041	2.064
20	0	20.00	0	0	1.161	1.822	1.854	1.884	1.913	1.941	1.968	1.994	2.019	2.043
20	2.5	19.50	2.25	0.25	1.177	1.827	1.859	1.889	1.918	1.946	1.973	1.998	2.023	2.047
20	5	19.00	4.5	0.5	1.195	1.833	1.864	1.894	1.923	1.951	1.977	2.003	2.028	2.052
20	7.5	18.50	6.75	0.75	1.212	1.838	1.869	1.899	1.928	1.956	1.982	2.008	2.032	2.056
20	10	18.00	9	1	1.230	1.844	1.875	1.905	1.933	1.961	1.987	2.013	2.037	2.061
20	12.5	17.50	11.25	1.25	1.249	1.850	1.881	1.910	1.939	1.966	1.993	2.018	2.042	2.066
20	15	17.00	13.5	1.5	1.268	1.856	1.887	1.916	1.945	1.972	1.998	2.023	2.048	2.071
22	0	22.00	0	0	1.180	1.829	1.861	1.891	1.920	1.948	1.975	2.001	2.026	2.050
22	2.5	21.45	2.25	0.25	1.196	1.834	1.866	1.896	1.925	1.953	1.979	2.005	2.030	2.054
22	5	20.90	4.5	0.5	1.214	1.840	1.871	1.901	1.930	1.958	1.984	2.010	2.035	2.058
22	7.5	20.35	6.75	0.75	1.231	1.845	1.876	1.906	1.935	1.963	1.989	2.015	2.039	2.063
22	10	19.80	9	1	1.249	1.851	1.882	1.912	1.940	1.968	1.994	2.020	2.044	2.068
22	12.5	19.25	11.25	1.25	1.268	1.857	1.888	1.918	1.946	1.973	2.000	2.025	2.049	2.073
22	15	18.70	13.5	1.5	1.288	1.863	1.894	1.924	1.952	1.979	2.005	2.030	2.055	2.078
24	0	24.00	0	0	1.199	1.837	1.868	1.898	1.927	1.955	1.982	2.008	2.033	2.057
24	2.5	23.40	2.25	0.25	1.216	1.842	1.873	1.903	1.932	1.960	1.987	2.012	2.037	2.061
24	5	22.80	4.5	0.5	1.233	1.847	1.878	1.908	1.937	1.965	1.991	2.017	2.042	2.065
24	7.5	22.20	6.75	0.75	1.251	1.853	1.884	1.914	1.942	1.970	1.996	2.022	2.046	2.070
24	10	21.60	9	1	1.269	1.859	1.890	1.919	1.948	1.975	2.002	2.027	2.051	2.075
24	12.5	21.00	11.25	1.25	1.288	1.865	1.896	1.925	1.954	1.981	2.007	2.032	2.056	2.080
24	15	20.40	13.5	1.5	1.307	1.871	1.902	1.931	1.959	1.987	2.013	2.038	2.062	2.085
26	0	26.00	0	0	1.220	1.844	1.876	1.906	1.935	1.963	1.989	2.015	2.040	2.064
26	2.5	25.35	2.25	0.25	1.236	1.849	1.881	1.911	1.940	1.967	1.994	2.020	2.044	2.068
26	5	24.70	4.5	0.5	1.254	1.855	1.886	1.916	1.945	1.972	1.999	2.024	2.049	2.073
26	7.5	24.05	6.75	0.75	1.271	1.861	1.892	1.921	1.950	1.978	2.004	2.029	2.054	2.077
26	10	23.40	9	1	1.290	1.867	1.897	1.927	1.956	1.983	2.009	2.034	2.059	2.082
26	12.5	22.75	11.25	1.25	1.308	1.873	1.903	1.933	1.961	1.989	2.015	2.040	2.064	2.087
26	15	22.10	13.5	1.5	1.328	1.879	1.910	1.939	1.967	1.994	2.020	2.045	2.069	2.092
28	0	28.00	0	0	1.240	1.852	1.884	1.914	1.943	1.970	1.997	2.023	2.048	2.071
28	2.5	27.30	2.25	0.25	1.257	1.857	1.889	1.919	1.948	1.975	2.002	2.027	2.052	2.076
28	5	26.60	4.5	0.5	1.275	1.863	1.894	1.924	1.953	1.980	2.007	2.032	2.057	2.080
28	7.5	25.90	6.75	0.75	1.292	1.869	1.900	1.930	1.958	1.985	2.012	2.037	2.062	2.085
28	10	25.20	9	1	1.311	1.875	1.906	1.935	1.964	1.991	2.017	2.042	2.067	2.090
28	12.5	24.50	11.25	1.25	1.329	1.881	1.912	1.941	1.969	1.997	2.023	2.048	2.072	2.095
28	15	23.80	13.5	1.5	1.349	1.887	1.918	1.947	1.975	2.002	2.028	2.053	2.077	2.100
30	0	30.00	0	0	1.262	1.861	1.892	1.922	1.951	1.978	2.005	2.031	2.056	2.079
30	2.5	29.25	2.25	0.25	1.279	1.866	1.897	1.927	1.956	1.983	2.010	2.035	2.060	2.084
30	5	28.50	4.5	0.5	1.296	1.871	1.903	1.932	1.961	1.988	2.015	2.040	2.065	2.088
30	7.5	27.75	6.75	0.75	1.314	1.877	1.908	1.938	1.966	1.994	2.020	2.045	2.070	2.093
30	10	27.00	9	1	1.332	1.883	1.914	1.944	1.972	1.999	2.025	2.050	2.075	2.098
30	12.5	26.25	11.25	1.25	1.351	1.890	1.920	1.950	1.978	2.005	2.031	2.056	2.080	2.103
30	15	25.50	13.5	1.5	1.371	1.896	1.927	1.956	1.984	2.011	2.037	2.061	2.085	2.108
32	0	32.00	0	0	1.285	1.869	1.901	1.931	1.959	1.987	2.014	2.039	2.064	2.088
32	2.5	31.20	2.25	0.25	1.302	1.875	1.906	1.936	1.964	1.992	2.018	2.044	2.068	2.092
32	5	30.40	4.5	0.5	1.319	1.880	1.911	1.941	1.970	1.997	2.023	2.049	2.073	2.097
32	7.5	29.60	6.75	0.75	1.337	1.886	1.917	1.947	1.975	2.002	2.029	2.054	2.078	2.101
32	10	28.80	9	1	1.355	1.892	1.923	1.953	1.981	2.008	2.034	2.059	2.083	2.106
32	12.5	28.00	11.25	1.25	1.374	1.899	1.929	1.959	1.987	2.014	2.040	2.064	2.088	2.111
32	15	27.20	13.5	1.5	1.393	1.905	1.936	1.965	1.993	2.020	2.045	2.070	2.094	2.117
34	0	34.00	0	0	1.308	1.878	1.910	1.940	1.968	1.996	2.022	2.048	2.072	2.096
34	2.5	33.15	2.25	0.25	1.325	1.884	1.915	1.945	1.973	2.001	2.027	2.053	2.077	2.101
34	5	32.30	4.5	0.5	1.342	1.890	1.921	1.950	1.979	2.006	2.032	2.057	2.082	2.105
34	7.5	31.45	6.75	0.75	1.360	1.896	1.926	1.956	1.984	2.011	2.037	2.063	2.087	2.110
34	10	30.60	9	1	1.378	1.902	1.932	1.962	1.990	2.017	2.043	2.068	2.092	2.115
34	12.5	29.75	11.25	1.25	1.397	1.908	1.939	1.968	1.996	2.023	2.049	2.073	2.097	2.120
34	15	28.90	13.5	1.5	1.416	1.915	1.945	1.974	2.002	2.029	2.054	2.079	2.103	2.125
36	0	36.00	0	0	1.332	1.888	1.919	1.949	1.978	2.005	2.032	2.057	2.081	2.105
36	2.5	35.10	2.25	0.25	1.349	1.894	1.925	1.954	1.983	2.010	2.036	2.062	2.086	2.110
36	5	34.20	4.5	0.5	1.366	1.899	1.930	1.960	1.988	2.015	2.042	2.067	2.091	2.114
36	7.5	33.30	6.75	0.75	1.384	1.905	1.936	1.965	1.994	2.021	2.047	2.072	2.096	2.119
36	10	32.40	9	1	1.402	1.912	1.942	1.971	1.999	2.026	2.052	2.077	2.101	2.124
36	12.5	31.50	11.25	1.25	1.421	1.918	1.948	1.978	2.005	2.032	2.058	2.083	2.106	2.129
36	15	30.60	13.5	1.5	1.440	1.925	1.955	1.984	2.012	2.038	2.064	2.088	2.112	2.135
38	0	38.00	0	0	1.357	1.898	1.929	1.959	1.987	2.015	2.041	2.067	2.091	2.114
38	2.5	37.05	2.25	0.25	1.374	1.904	1.935	1.964	1.993	2.020	2.046	2.071	2.096	2.119
38	5	36.10	4.5	0.5	1.391	1.909	1.940	1.970	1.998	2.025	2.051	2.076	2.100	2.124
38	7.5	35.15	6.75	0.75	1.409	1.916	1.946	1.976	2.004	2.031	2.057	2.082	2.105	2.129
38	10	34.20	9	1	1.427	1.922	1.952	1.982	2.010	2.036	2.062	2.087	2.111	2.134
38	12.5	33.25	11.25	1.25	1.446	1.928	1.959	1.988	2.016	2.042	2.068	2.092	2.116	2.139
38	15	32.30	13.5	1.5	1.465	1.935	1.965	1.994	2.022	2.048	2.074	2.098	2.122	2.144
40	0	40.00	0	0	1.383	1.909	1.940	1.969	1.998	2.025	2.051	2.077	2.101	2.124
40	2.5	39.00	2.25	0.25	1.400	1.914	1.945	1.975	2.003	2.030	2.056	2.081	2.106	2.129
40	5	38.00	4.5	0.5	1.417	1.920	1.951	1.980	2.008	2.036	2.062	2.086	2.110	2.134
40	7.5	37.00	6.75	0.75	1.435	1.926	1.957	1.986	2.014	2.041	2.067	2.092	2.116	2.138
40	10	36.00	9	1	1.453	1.933	1.963	1.992	2.020	2.047	2.072	2.097	2.121	2.144
40	12.5	35.00	11.25	1.25	1.472	1.939	1.969	1.998	2.026	2.053	2.078	2.103	2.126	2.149
40	15	34.00	13.5	1.5	1.491	1.946	1.976	2.005	2.032	2.059	2.084	2.108	2.132	2.154

LINEAR REGRESSION OF INPUT SP. GR. vS OUTPUT SP. GR.

For Pozzolan Sp. Gr. of 2.6

Regression Output:

Constant		1.384150
Std Err of Y Est		0.002531
R Squared		0.996972
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.375473	
Std Err of Coef.	0.001718	

For Pozzolan Sp. Gr. of 2.7

Regression Output:

Constant		1.418864
Std Err of Y Est		0.002641
R Squared		0.996652
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.372562	
Std Err of Coef.	0.001793	

For Pozzolan Sp. Gr. of 2.8

Regression Output:

Constant		1.452517
Std Err of Y Est		0.002754
R Squared		0.996300
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.369484	
Std Err of Coef.	0.001870	

For Pozzolan Sp. Gr. of 2.9

Regression Output:

Constant		1.485152
Std Err of Y Est		0.002869
R Squared		0.995916
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.366264	
Std Err of Coef.	0.001948	

For Pozzolan Sp. Gr. of 3.0

Regression Output:

Constant		1.516810
Std Err of Y Est		0.002985
R Squared		0.995500
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.362928	
Std Err of Coef.	0.002026	

For Pozzolan Sp. Gr. of 3.1

Regression Output:

Constant		1.5475297472761
Std Err of Y Est		0.0031013848402724
R Squared		0.99505073776957
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.359494	
Std Err of Coef.	0.002106	

For Pozzolan Sp. Gr. of 3.2

Regression Output:

Constant		1.5773496378365
Std Err of Y Est		0.0032179405060818
R Squared		0.99456871473503
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.355982	
Std Err of Coef.	0.002185	

For Pozzolan Sp. Gr. of 3.3

Regression Output:

Constant		1.6063052883581
Std Err of Y Est		0.0033342346328558
R Squared		0.99405322217192
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.352407	
Std Err of Coef.	0.002264	

For Pozzolan Sp. Gr. of 3.4

Regression Output:

Constant		1.634431
Std Err of Y Est		0.003450
R Squared		0.993504
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.348782	
Std Err of Coef.	0.002342	

POZZOLAN SPECIFIC GRAVITY	X COEFF-ICIENT m	Y INTER-CEPT c
2.6	0.3754729	1.3841499
2.7	0.3725622	1.4188639
2.8	0.3694837	1.4525169
2.9	0.3662644	1.4851518
3.0	0.3629278	1.5168097
3.1	0.3594943	1.5475297
3.2	0.3559820	1.5773496
3.3	0.3524067	1.6063053
3.4	0.3487819	1.6344310

LINEAR REGRESSION OF X COEFFICIENT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant		0.463099
Std Err of Y Est		0.000335
R Squared		0.998832
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	-0.033501	
Std Err of Coef.	0.000433	

LINEAR REGRESSION OF Y INTERCEPT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:

Constant		0.575932
Std Err of Y Est		0.003119
R Squared		0.998840
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	0.312582	
Std Err of Coef.	0.004026	

TABLE G-24

207C/CLARIFIER

OUTPUT PRODUCT SPECIFIC GRAVITIES FOR DIFFERENT TDS & TSS CONDITIONS FOR A WATER TO POZZOLAN RATIO OF 0.42
WITH CLARIFIER SILT AS PERCENTAGE OF TOTAL SILT = 100%

SPECIFIC GRAVITY OF POZZOLANS						2.600	2.70	2.80	2.90	3.00	3.10	3.20	3.30	3.40
SPECIFIC GRAVITY OF SALT						3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251	3.251
SPECIFIC GRAVITY OF SILT						2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23
SPECIFIC GRAVITY OF CLAR. SILT						2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73
W/P RATIO						0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
(%)						100	100	100	100	100	100	100	100	100
TDS %	TSS %	SALT %	CLAR SILT %	SILT %	INPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.	OUTPUT SP. GR.
0	0	0.00	0	0	1.000	1.765	1.797	1.827	1.857	1.885	1.912	1.939	1.964	1.988
0	2.5	0.00	2.5	0	1.016	1.770	1.801	1.832	1.861	1.889	1.917	1.943	1.968	1.993
0	5	0.00	5	0	1.033	1.774	1.806	1.837	1.866	1.894	1.921	1.947	1.972	1.997
0	7.5	0.00	7.5	0	1.050	1.780	1.811	1.841	1.871	1.899	1.926	1.952	1.977	2.001
0	10	0.00	10	0	1.068	1.785	1.816	1.847	1.876	1.904	1.931	1.957	1.982	2.006
0	12.5	0.00	12.5	0	1.086	1.790	1.822	1.852	1.881	1.909	1.936	1.962	1.987	2.011
0	15	0.00	15	0	1.105	1.796	1.828	1.858	1.887	1.914	1.941	1.967	1.992	2.016
2	0	2.00	0	0	1.014	1.770	1.801	1.832	1.861	1.890	1.917	1.943	1.969	1.993
2	2.5	1.95	2.5	0	1.030	1.774	1.806	1.837	1.866	1.894	1.921	1.948	1.973	1.997
2	5	1.90	5	0	1.047	1.779	1.811	1.841	1.871	1.899	1.926	1.952	1.977	2.002
2	7.5	1.85	7.5	0	1.064	1.785	1.816	1.846	1.876	1.904	1.931	1.957	1.982	2.006
2	10	1.80	10	0	1.082	1.790	1.821	1.852	1.881	1.909	1.936	1.962	1.987	2.011
2	12.5	1.75	12.5	0	1.101	1.796	1.827	1.857	1.886	1.914	1.941	1.967	1.991	2.015
2	15	1.70	15	0	1.120	1.802	1.833	1.863	1.892	1.919	1.946	1.972	1.997	2.021
4	0	4.00	0	0	1.028	1.775	1.806	1.837	1.866	1.895	1.922	1.948	1.973	1.998
4	2.5	3.90	2.5	0	1.045	1.780	1.811	1.842	1.871	1.899	1.926	1.952	1.978	2.002
4	5	3.80	5	0	1.062	1.785	1.816	1.847	1.876	1.904	1.931	1.957	1.982	2.006
4	7.5	3.70	7.5	0	1.079	1.790	1.821	1.852	1.881	1.909	1.936	1.962	1.987	2.011
4	10	3.60	10	0	1.097	1.795	1.827	1.857	1.886	1.914	1.941	1.967	1.992	2.016
4	12.5	3.50	12.5	0	1.115	1.801	1.832	1.862	1.891	1.919	1.946	1.972	1.997	2.020
4	15	3.40	15	0	1.135	1.807	1.838	1.868	1.897	1.925	1.951	1.977	2.002	2.026
6	0	6.00	0	0	1.043	1.780	1.812	1.842	1.872	1.900	1.927	1.953	1.978	2.003
6	2.5	5.85	2.5	0	1.060	1.785	1.816	1.847	1.876	1.904	1.931	1.958	1.983	2.007
6	5	5.70	5	0	1.077	1.790	1.821	1.852	1.881	1.909	1.936	1.962	1.987	2.011
6	7.5	5.55	7.5	0	1.094	1.795	1.827	1.857	1.886	1.914	1.941	1.967	1.992	2.016
6	10	5.40	10	0	1.112	1.801	1.832	1.862	1.891	1.919	1.946	1.972	1.997	2.021
6	12.5	5.25	12.5	0	1.131	1.806	1.838	1.868	1.897	1.924	1.951	1.977	2.002	2.026
6	15	5.10	15	0	1.150	1.812	1.844	1.874	1.902	1.930	1.957	1.982	2.007	2.031
8	0	8.00	0	0	1.059	1.785	1.817	1.847	1.877	1.905	1.932	1.958	1.984	2.008
8	2.5	7.80	2.5	0	1.075	1.790	1.822	1.852	1.882	1.910	1.937	1.963	1.988	2.012
8	5	7.60	5	0	1.092	1.795	1.827	1.857	1.886	1.914	1.941	1.967	1.992	2.017
8	7.5	7.40	7.5	0	1.110	1.801	1.832	1.862	1.891	1.919	1.946	1.972	1.997	2.021
8	10	7.20	10	0	1.128	1.806	1.838	1.868	1.897	1.925	1.951	1.977	2.002	2.026
8	12.5	7.00	12.5	0	1.146	1.812	1.843	1.873	1.902	1.930	1.957	1.982	2.007	2.031
8	15	6.80	15	0	1.166	1.818	1.849	1.879	1.908	1.936	1.962	1.988	2.012	2.036
10	0	10.00	0	0	1.074	1.791	1.823	1.853	1.882	1.910	1.938	1.964	1.989	2.013
10	2.5	9.75	2.5	0	1.091	1.796	1.827	1.858	1.887	1.915	1.942	1.968	1.993	2.018
10	5	9.50	5	0	1.108	1.801	1.833	1.863	1.892	1.920	1.947	1.973	1.998	2.022
10	7.5	9.25	7.5	0	1.126	1.806	1.838	1.868	1.897	1.925	1.952	1.978	2.003	2.027
10	10	9.00	10	0	1.144	1.812	1.843	1.874	1.902	1.930	1.957	1.983	2.008	2.032
10	12.5	8.75	12.5	0	1.163	1.818	1.849	1.879	1.908	1.936	1.962	1.988	2.013	2.037
10	15	8.50	15	0	1.182	1.824	1.855	1.885	1.914	1.941	1.968	1.994	2.018	2.042
12	0	12.00	0	0	1.091	1.797	1.828	1.859	1.888	1.916	1.943	1.969	1.995	2.019
12	2.5	11.70	2.5	0	1.107	1.802	1.833	1.864	1.893	1.921	1.948	1.974	1.999	2.023
12	5	11.40	5	0	1.124	1.807	1.838	1.869	1.898	1.926	1.953	1.979	2.004	2.028
12	7.5	11.10	7.5	0	1.142	1.812	1.844	1.874	1.903	1.931	1.958	1.983	2.008	2.032
12	10	10.80	10	0	1.160	1.818	1.850	1.880	1.908	1.936	1.963	1.989	2.013	2.037
12	12.5	10.50	12.5	0	1.179	1.824	1.855	1.885	1.914	1.942	1.968	1.994	2.019	2.042
12	15	10.20	15	0	1.199	1.830	1.861	1.891	1.920	1.947	1.974	1.999	2.024	2.048
14	0	14.00	0	0	1.107	1.803	1.834	1.865	1.894	1.922	1.949	1.975	2.000	2.025
14	2.5	13.65	2.5	0	1.124	1.808	1.839	1.870	1.899	1.927	1.954	1.980	2.005	2.029
14	5	13.30	5	0	1.141	1.813	1.845	1.875	1.904	1.932	1.959	1.985	2.009	2.034
14	7.5	12.95	7.5	0	1.159	1.819	1.850	1.880	1.909	1.937	1.964	1.989	2.014	2.038
14	10	12.60	10	0	1.177	1.824	1.856	1.886	1.915	1.942	1.969	1.995	2.019	2.043
14	12.5	12.25	12.5	0	1.196	1.831	1.862	1.892	1.920	1.948	1.974	2.000	2.025	2.048
14	15	11.90	15	0	1.216	1.837	1.868	1.898	1.926	1.954	1.980	2.006	2.030	2.054
16	0	16.00	0	0	1.125	1.809	1.841	1.871	1.900	1.928	1.955	1.981	2.006	2.031
16	2.5	15.60	2.5	0	1.141	1.814	1.846	1.876	1.905	1.933	1.960	1.986	2.011	2.035
16	5	15.20	5	0	1.159	1.820	1.851	1.881	1.910	1.938	1.965	1.991	2.016	2.040
16	7.5	14.80	7.5	0	1.176	1.825	1.856	1.887	1.915	1.943	1.970	1.996	2.020	2.044
16	10	14.40	10	0	1.195	1.831	1.862	1.892	1.921	1.949	1.975	2.001	2.025	2.049
16	12.5	14.00	12.5	0	1.214	1.837	1.868	1.898	1.927	1.954	1.981	2.006	2.031	2.054
16	15	13.60	15	0	1.233	1.843	1.874	1.904	1.933	1.960	1.987	2.012	2.036	2.060
18	0	18.00	0	0	1.142	1.815	1.847	1.877	1.906	1.935	1.961	1.987	2.013	2.037
18	2.5	17.55	2.5	0	1.159	1.821	1.852	1.882	1.911	1.939	1.966	1.992	2.017	2.041
18	5	17.10	5	0	1.177	1.826	1.858	1.888	1.917	1.944	1.971	1.997	2.022	2.046
18	7.5	16.65	7.5	0	1.194	1.832	1.863	1.893	1.922	1.950	1.976	2.002	2.027	2.051
18	10	16.20	10	0	1.213	1.839	1.869	1.899	1.928	1.955	1.982	2.007	2.032	2.056
18	12.5	15.75	12.5	0	1.232	1.844	1.875	1.905	1.933	1.961	1.987	2.013	2.037	2.061
18	15	15.30	15	0	1.252	1.850	1.881	1.911	1.939	1.967	1.993	2.018	2.043	2.066
20	0	20.00	0	0	1.161	1.822	1.854	1.884	1.913	1.941	1.968	1.994	2.019	2.043
20	2.5	19.50	2.5	0	1.178	1.827	1.859	1.889	1.918	1.946	1.973	1.999	2.024	2.048
20	5	19.00	5	0	1.195	1.833	1.864	1.894	1.923	1.951	1.978	2.004	2.028	2.052
20	7.5	18.50	7.5	0	1.213	1.839	1.870	1.900	1.929	1.956	1.983	2.009	2.033	2.057
20	10	18.00	10	0	1.232	1.845	1.876	1.906	1.934	1.962	1.988	2.014	2.039	2.062
20	12.5	17.50	12.5	0	1.251	1.851	1.882	1.912	1.940	1.968	1.994	2.020	2.044	2.067
20	15	17.00	15	0	1.270	1.858	1.888	1.918	1.946	1.974	2.000	2.025	2.050	2.073
22	0	22.00	0	0	1.180	1.829	1.861	1.891	1.920	1.948	1.975	2.001	2.026	2.050
22	2.5	21.45	2.5	0	1.197	1.835	1.866	1.896	1.925	1.953	1.980	2.006	2.030	2.054
22	5	20.90	5	0	1.214	1.840	1.872	1.902	1.930	1.958	1.985	2.010	2.035	2.059
22	7.5	20.35	7.5	0	1.232	1.846	1.877	1.907	1.936	1.964	1.990	2.016	2.040	2.064
22	10	19.80	10	0	1.251	1.852	1.883	1.913	1.942	1.969	1.996	2.021	2.045	2.069
22	12.5	19.25	12.5	0	1.270	1.858	1.889	1.919	1.948	1.975	2.001	2.027	2.051	2.074
22	15	18.70	15	0	1.290	1.865	1.896	1.925	1.954	1.981	2.007	2.032	2.057	2.080
24	0	24.00	0	0	1.199	1.837	1.868	1.898	1.927	1.955	1.982	2.008	2.033	2.057
24	2.5	23.40	2.5	0	1.216	1.842	1.873	1.903	1.932	1.960	1.987	2.013	2.037	2.061
24	5	22.80	5	0	1.234	1.848	1.879	1.909	1.938	1.965	1.992	2.018	2.042	2.066
24	7.5	22.20	7.5	0	1.252	1.854	1.885	1.915	1.943	1.971	1.997	2.023	2.047	2.071
24	10	21.60	10	0	1.271	1.860	1.891	1.920	1.949	1.976	2.003	2.028	2.053	2.076
24	12.5	21.00	12.5	0	1.290	1.866	1.897	1.927	1.955	1.982	2.009	2.034	2.058	2.082
24	15	20.40	15	0	1.309	1.873	1.904	1.933	1.961	1.988	2.015	2.040	2.064	2.087
26	0	26.00	0	0	1.220	1.844	1.876	1.906	1.935	1.963	1.989	2.015	2.040	2.064
26	2.5	25.35	2.5	0	1.237	1.850	1.881	1.911	1.940	1.968	1.994	2.020	2.045	2.069
26	5	24.70	5	0	1.254	1.855	1.887	1.917	1.945	1.973	2.000	2.025	2.050	2.073
26	7.5	24.05	7.5	0	1.272	1.861	1.893	1.922	1.951	1.978	2.005	2.030	2.055	2.078
26	10	23.40	10	0	1.291	1.868	1.899	1.928	1.957	1.984	2.010	2.036	2.060	2.084
26	12.5	22.75	12.5	0	1.310	1.874	1.905	1.935	1.963	1.990	2.016	2.041	2.066	2.089
26	15	22.10	15	0	1.330	1.881	1.912	1.941	1.969	1.996	2.022	2.047	2.071	2.095
28	0	28.00	0	0	1.240	1.852	1.884	1.914	1.943	1.970	1.997	2.023	2.048	2.071
28	2.5	27.30	2.5	0	1.258	1.858	1.889	1.919	1.948	1.976	2.002	2.028	2.052	2.076
28	5	26.60	5	0	1.275	1.864	1.895	1.925	1.953	1.981	2.007	2.033	2.057	2.081
28	7.5	25.90	7.5	0	1.293	1.870	1.901	1.930	1.959	1.986	2.013	2.038	2.063	2.086
28	10	25.20	10	0	1.312	1.876	1.907	1.936	1.965	1.992	2.018	2.044	2.068	2.091
28	12.5	24.50	12.5	0	1.331	1.882	1.913	1.943	1.971	1.998	2.024	2.049	2.073	2.097
28	15	23.80	15	0	1.351	1.889	1.920	1.949	1.977	2.004	2.030	2.055	2.079	2.102
30	0	30.00	0	0	1.262	1.861	1.892	1.922	1.951	1.978	2.005	2.031	2.056	2.079
30	2.5	29.25	2.5	0	1.279	1.866	1.897	1.927	1.956	1.984	2.010	2.036	2.060	2.084
30	5	28.50	5	0	1.297	1.872	1.903	1.933	1.962	1.989	2.016	2.041	2.065	2.089
30	7.5	27.75	7.5	0	1.315	1.878	1.909	1.939	1.967	1.995	2.021	2.046	2.071	2.094
30	10	27.00	10	0	1.334	1.885	1.915	1.945	1.973	2.001	2.027	2.052	2.076	2.099
30	12.5	26.25	12.5	0	1.353	1.891	1.922	1.951	1.979	2.007	2.033	2.058	2.082	2.105
30	15	25.50	15	0	1.373	1.898	1.929	1.958	1.986	2.013	2.039	2.064	2.088	2.111
32	0	32.00	0	0	1.285	1.869	1.901	1.931	1.959	1.987	2.014	2.039	2.064	2.088
32	2.5	31.20	2.5	0	1.302	1.875	1.906	1.936	1.965	1.992	2.019	2.044	2.069	2.092
32	5	30.40	5	0	1.320	1.881	1.912	1.942	1.970	1.998	2.024	2.049	2.074	2.097
32	7.5	29.60	7.5	0	1.338	1.887	1.918	1.948	1.976	2.003	2.030	2.055	2.079	2.102
32	10	28.80	10	0	1.356	1.894	1.924	1.954	1.982	2.009	2.035	2.060	2.084	2.108
32	12.5	28.00	12.5	0	1.376	1.900	1.931	1.960	1.988	2.015	2.041	2.066	2.090	2.113
32	15	27.20	15	0	1.395	1.907	1.938	1.967	1.995	2.022	2.047	2.072	2.096	2.119
34	0	34.00	0	0	1.308	1.878	1.910	1.940	1.968	1.996	2.022	2.048	2.072	2.096
34	2.5	33.15	2.5	0	1.325	1.884	1.915	1.945	1.974	2.001	2.028	2.053	2.077	2.101
34	5	32.30	5	0	1.343	1.890	1.921	1.951	1.979	2.007	2.033	2.058	2.083	2.106
34	7.5	31.45	7.5	0	1.361	1.896	1.927	1.957	1.985	2.012	2.039	2.064	2.088	2.111
34	10	30.60	10	0	1.380	1.903	1.934	1.963	1.991	2.018	2.044	2.069	2.093	2.116
34	12.5	29.75	12.5	0	1.399	1.910	1.940	1.970	1.998	2.024	2.050	2.075	2.099	2.122
34	15	28.90	15	0	1.419	1.917	1.947	1.976	2.004	2.031	2.057	2.081	2.105	2.128
36	0	36.00	0	0	1.332	1.888	1.919	1.949	1.978	2.005	2.032	2.057	2.081	2.105
36	2.5	35.10	2.5	0	1.349	1.894	1.925	1.955	1.983	2.011	2.037	2.062	2.086	2.110
36	5	34.20	5	0	1.367	1.900	1.931	1.960	1.989	2.016	2.042	2.067	2.092	2.115
36	7.5	33.30	7.5	0	1.385	1.906	1.937	1.966	1.995	2.022	2.048	2.073	2.097	2.120
36	10	32.40	10	0	1.404	1.913	1.943	1.973	2.001	2.028	2.054	2.079	2.103	2.126
36	12.5	31.50	12.5	0	1.423	1.920	1.950	1.979	2.007	2.034	2.060	2.085	2.108	2.131
36	15	30.60	15	0	1.443	1.927	1.957	1.986	2.014	2.041	2.066	2.091	2.114	2.137
38	0	38.00	0	0	1.357	1.898	1.929	1.959	1.987	2.015	2.041	2.067	2.091	2.114
38	2.5	37.05	2.5	0	1.374	1.904	1.935	1.965	1.993	2.020	2.047	2.072	2.096	2.119
38	5	36.10	5	0	1.392	1.910	1.941	1.970	1.999	2.026	2.052	2.077	2.101	2.124
38	7.5	35.15	7.5	0	1.410	1.916	1.947	1.977	2.005	2.032	2.058	2.083	2.107	2.130
38	10	34.20	10	0	1.429	1.923	1.954	1.983	2.011	2.038	2.064	2.088	2.112	2.135
38	12.5	33.25	12.5	0	1.448	1.930	1.960	1.990	2.017	2.044	2.070	2.094	2.118	2.141
38	15	32.30	15	0	1.468	1.937	1.967	1.996	2.024	2.051	2.076	2.101	2.124	2.147
40	0	40.00	0	0	1.383	1.909	1.940	1.969	1.998	2.025	2.051	2.077	2.101	2.124
40	2.5	39.00	2.5	0	1.400	1.915	1.945	1.975	2.003	2.031	2.057	2.082	2.106	2.129
40	5	38.00	5	0	1.418	1.921	1.952	1.981	2.009	2.036	2.062	2.087	2.111	2.134
40	7.5	37.00	7.5	0	1.436	1.927	1.958	1.987	2.015	2.042	2.068	2.093	2.117	2.140
40	10	36.00	10	0	1.455	1.934	1.964	1.994	2.021	2.048	2.074	2.099	2.122	2.145
40	12.5	35.00	12.5	0	1.474	1.941	1.971	2.000	2.028	2.055	2.080	2.105	2.128	2.151
40	15	34.00	15	0	1.494	1.948	1.978	2.007	2.035	2.061	2.087	2.111	2.134	2.157

LINEAR REGRESSION OF INPUT SP. GR. vS OUTPUT SP. GR.

For Pozzolan Sp. Gr. of 2.6

Regression Output:		
Constant		1.383337
Std Err of Y Est		0.002307
R Squared		0.997512
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.376488	
Std Err of Coef.	0.001561	

For Pozzolan Sp. Gr. of 2.7

Regression Output:		
Constant		1.417994
Std Err of Y Est		0.002395
R Squared		0.997279
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.373648	
Std Err of Coef.	0.001621	

For Pozzolan Sp. Gr. of 2.8

Regression Output:		
Constant		1.451592
Std Err of Y Est		0.002486
R Squared		0.997021
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.370639	
Std Err of Coef.	0.001683	

For Pozzolan Sp. Gr. of 2.9

Regression Output:		
Constant		1.484172
Std Err of Y Est		0.002579
R Squared		0.996738
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.367487	
Std Err of Coef.	0.001746	

For Pozzolan Sp. Gr. of 3.0

Regression Output:		
Constant		1.515777
Std Err of Y Est		0.002675
R Squared		0.996431
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.364216	
Std Err of Coef.	0.001810	

For Pozzolan Sp. Gr. of 3.1

Regression Output:		
Constant		1.5464454732741
Std Err of Y Est		0.0027708965309283
R Squared		0.99609884256535
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.360848	
Std Err of Coef.	0.001875	

For Pozzolan Sp. Gr. of 3.2

Regression Output:		
Constant		1.5762148385135
Std Err of Y Est		0.0028679101999815
R Squared		0.99574136698281
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.357399	
Std Err of Coef.	0.001941	

For Pozzolan Sp. Gr. of 3.3

Regression Output:		
Constant		1.6051211793072
Std Err of Y Est		0.0029652300145066
R Squared		0.99535837296551
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.353885	
Std Err of Coef.	0.002007	

For Pozzolan Sp. Gr. of 3.4

Regression Output:		
Constant		1.633199
Std Err of Y Est		0.003063
R Squared		0.994950
No. of Observations		147
Degrees of Freedom		145
X Coefficient(s)	0.350321	
Std Err of Coef.	0.002073	

POZZOLAN SPECIFIC GRAVITY	X COEFF-ICIENT m	Y INTER-CEPT c
2.6	0.3764883	1.3833371
2.7	0.3736481	1.4179942
2.8	0.3706387	1.4515917
2.9	0.3674870	1.4841723
3.0	0.3642164	1.5157772
3.1	0.3608476	1.5464455
3.2	0.3573985	1.5762148
3.3	0.3538849	1.6051212
3.4	0.3503206	1.6331988

LINEAR REGRESSION OF X COEFFICIENT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:		
Constant		0.462421
Std Err of Y Est		0.000340
R Squared		0.998751
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	-0.032847	
Std Err of Coef.	0.000439	

LINEAR REGRESSION OF Y INTERCEPT vS POZZOLAN SPECIFIC GRAVITY

Regression Output:		
Constant		0.576477
Std Err of Y Est		0.003115
R Squared		0.998839
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	0.312058	
Std Err of Coef.	0.004021	